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THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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COLONIAL BRICKWORK.

THE whole eastern seaboard of this country is very richly endowed with deposits of clay suitable for the manufacture of brick and terra-cotta, and yet, although the first settlers in New England came directly from Holland, and were accustomed to brick in all its various forms, they were very slow to appreciate the possibilities of nature, and nearly all of the bricks used in the earlier colonial structures were imported from abroad. We had occasion some time since to visit Plymouth, and were much interested in seeing on Burial Hill the remains of the old fort which was built about 1625, and constructed of bricks imported from England. The structure itself has entirely disappeared from above ground, but every little while in disturbing the soil, fragments of old brick are found, evidently in very fair condition, though not of remarkably hard variety. In the Pilgrim Hall at Plymouth there are preserved some old bricks and tiles, which came from Marshfield, which were imported early in the seventeenth century. It was not until some considerable time after the freestone and granite quarries were opened that our early settlers began to appreciate that a more readily obtainable material was close at hand.

If we were called upon to formulate any reason for the undenied excellence of much of the colonial architecture which we find in this country, we should be inclined to ascribe this excellence in very large part to the fact that in those days such things as contracts, contract work, and architects were practically unknown. But this statement must not be understood as implying that a good architect is a detriment to a building, for in only one sense was the absence of the architect an advantage to the old work. All of us who have been through the mill appreciate how, in building almost any structure, we are prone to attempt to carry out a preconceived contract. If we have once laid it out on paper and made up our minds on paper that it ought to be about so and so, we are very apt to build it so, and if it doesn't come out quite as we expect we let it alone and try to do better next time; while on the part of the owner the feeling is so strong that changes involve extra expense that even if a change is really desirable the mere fact that it is presented by an architect or a contractor arouses the suspicion of the sometimes short-sighted owner.

In the colonial days things were done differently. We imagine the plans that existed in those days were few and far between, and the more probable procedure was for the village carpenter to start to work and frame his house without a very definite preconceived plan, except that in a general way he was to follow the lines laid down in some one of the few but generally safe architectural books at his command. After the walls were up the interior was changed about or worked up from time to time so as to give just the effect desired, and probably the exterior was handled in much the same way, so that in these buildings we find details which very generally seem to belong in place on the exterior, and within are found the charming nooks, chimney corners, or picturesque angles which are so distinctive of the best colonial work. It is not humanly possible for any architect to entirely foresee the full effect of his designs, and so long as we are tied to a contract, even though the opposition to changes may be slight, it is apt to be a hindrance to our molding the design so as to fit the necessities in the best manner. We believe that a return to the possibly more primitive manners of our forefathers would result in immeasurable good to our architecture of to-day, not only in its domestic manifestations, but also in its public buildings, where the limitations of preparatory studies as compared with final effects are even more marked. The old work which was done in this haphazard way was by no means always good, but among it there is considerable which our modern designers find very profitable to study. There is a vast deal of excellent old brickwork scattered along the Atlantic coast from Maine to Florida, which we think can be studied to most decided advantage.

ROMAN AND POMPEIAN BRICK.

IN the former days when a brick was nothing but a red parallelopipedon of approximately uniform dimensions, there was no need of names to designate varieties of brick, but with the advent of the light-colored burnt clays several appellations have been evolved, some of them with sufficient pertinence to stick and become a part of our architectural nomenclature. Two of these which are most common are the designations Roman and Pompeian. The origin of these terms is very manifest, and the names themselves appropriate to the shapes they designate. The ordinary common brick is approximately 2 by 4 by 8 ins., and this shape has obtained pretty generally in the past through France, the Netherlands, England, and this country. In Italy and in ancient Rome, however, bricks were very frequently made in different shapes. In much of the work in the Colosseum the bricks were triangular slabs of terra-cotta 1 to 2 ins. thick, and 8 ins. to a foot wide on each face, being laid side by side in courses with the points turned in to the wall, and backed up by and tied into a mass of concrete. Another very

common form was 15 or 16 ins. square and not over 1½ or 2 ins. thick. These bricks laid up in the wall with very thick joints are found in much of the old work, and suggested the manufacture of a brick 12 ins. long, 4 ins. wide, and 1½ ins. thick, which form has found a great deal of favor in modern work under the name of Roman brick. As a matter of fact it is Roman only in appearance on the exterior of the wall, as the old bricks were nearly square, but in a decorative sense the term fits very fairly. The term applies wholly to the shape of the brick, being entirely independent of color or material.

Texture, that indefinite quality which is so much sought after by our architects, is a marked feature of much of the old brickwork which has been exposed to stresses of weather. Some of the old brickwork in Pompeii seems to have been made with a mixture of rather coarse volcanic sand or cinders in with the clay, which on burning would show black spots at irregular intervals over the surface. This is the prototype of what we to-day style Pompeian brick, which presents an appearance of having scattered through it a lot of rather fine, thoroughly burned cinders, giving a speckled appearance to the exterior, which for some purposes is very pleasing. These bricks suggest a wall which has passed through a conflagration, the brick having an over-burnt appearance, such as might be expected of brick dug out of a city buried for centuries under the deposits of a volcano. As a matter of fact it would be hard to find many bricks in Pompeii itself which bear any close resemblance to the speckled bricks which now are designated by the name of that city. Still the appellation is a fair one, and one which seems to fit the case, and has found sufficient favor to be considered as a permanence. The term applies wholly to the mottled, cinder-specked appearance being entirely independent of shape or size.

WHILE the science of fire-proofing, as practised and applied to large buildings in this country, leaves a good deal to be desired in some directions, the paper by Mr. Gibson, the publication of which will begin with this issue of THE BRICKBUILDER, is the best of evidence of the extent to which this science has been developed and the certainty with which it can be applied to accomplish desired results. There have been many publications within the past three or four years dealing upon this subject, and such large fires as that in the Horne Buildings, Pittsburgh, or the Home Life Building, New York, have called forth some very excellent symposiums upon the subject; but we cannot recall a single article which, on the whole, is so clearly and fully expressed, and which deals with all sides of the subject so satisfactorily as this paper. It is a thoughtful, well-rounded, and complete study of one of the most vital questions with which architects and constructors to-day have to deal.

NEW BOOKS.

IN a volume of a little over three hundred pages, Mr. Freitag has presented a very complete study of the fire-proofing of steel buildings, including a *résumé* of the development of methods in the history of steel building construction, with reports of tests of various fire-proof floors, and a careful analysis of the various systems at present on the market. The volume is an evidence of the development of this branch of building construction from a crude and little-understood, hand-to-hand system to a scientific, carefully-devised method, by which, on the whole, the results desired are achieved, notwithstanding the repeated fires in so-called fire-proof buildings. Mr. Freitag's book is a valuable addition to the current literature on the subject.

THE FIRE-PROOFING OF STEEL BUILDINGS. By J. K. Freitag, C. E. New York, John Wiley & Sons. London, Chapman & Hall, Limited, 1899.

There is a mass of data referring to the humdrum, every-day details of practise in architecture, which constitutes what might almost be termed the common law of the profession, and which is very seldom formulated in the shape of a book, but which is in some mysterious way handed down from generation to generation of draftsmen, and with slight variations in different offices is essentially the same, debarring local variations. This includes the current practise in regard to such matter-of-fact details as windows, doors, transom lights, cellar windows, and the constructive minutia of wood finish. All of these have been gathered into a very handy form under the title of "Details of Building Construction," by Clarence A. Martin, Assistant Professor of Architecture, Cornell University. It is a work which will fill a want but partially met by office traditions and the rare works of similar description which are now on the market, and it is so eminently in accord with the best practise that there is but little to find fault with.

DETAILS OF BUILDING CONSTRUCTION. By Clarence A. Martin, Assistant Professor of Architecture, Cornell University. Boston, Bates & Guild Company. $2.00.

PERSONAL AND CLUB NEWS.

V. EMILE THÉBAUD, architect, has opened an office in the Dun Building, Buffalo, N. Y.

JOHN W. VICKERY, architect, has opened an office at 905 Chamber of Commerce Building, Rochester, N. Y.

THE supervising architect for the Pan-American Exposition of Buffalo, in 1901, will be H. S. Kissam, of New York City, who for some years past has been an associate and general manager with Ernest Flagg.

PAUL A. DAVIS, 3D, who for some years has been studying abroad, having made a record at the École des Beaux Arts which would have been phenomenal for even a Frenchman, has returned to Philadelphia to practise architecture.

FRANK EATON NEWMAN, Henry Gillette Woodman, and James Russell Harris, Jr., announce that they have formed a copartnership under the firm name of Newman, Woodman & Harris, architects, Real Estate Trust Building, Philadelphia.

WE are in receipt of a circular of information sent out by the T Square Club, which society, as usual, finds itself in the van of architectural progress. Our readers will remember the convention of architectural club delegates which met last year at Cleveland, and which resulted in the organization of the Architectural League of America. If this league accomplishes no further result than to systematize the various architectural exhibitions throughout the country, it will have served a thoroughly good purpose, and apparently this has been brought about very largely, we imagine, through the active agency of the members of the T Square Club, which is to have its exhibition from Dec. 16, 1899, to Jan. 6, 1900. It is the intention that drawings intended for the T Square Club exhibition shall be sent on a circuit among the various clubs, including in rotation the Architectural League of New York, the Chicago Architectural Club, the St. Louis Architectural Club, the Detroit Architectural Club, the Cleveland Architectural Club, and the Pittsburgh Architectural Club. This would imply that drawings sent in now would be absent from their authors until about the first of July. It would also mean that, instead of having to contribute to seven different organizations, our architects can concentrate their energies on a single lot of drawings which will go the rounds of the whole; and while we can hardly hope that the individual lot will be seven times as good as the collective value of the seven separate exhibits might be, it is still quite probable that this scheme of cooperation will result in more serious work on the part of the contributors, and far better results from the standpoint of the clubs. This move is entirely to be commended, and the T Square Club for its share therein is worthy of all praise. For any further information in regard to the exhibition, reference can be made to David Knickerbacker Boyd, Harrison Building, Phildelphia.

A Village Church, Cost Fifty Thousand Dollars.

BY T. HENRY RANDALL.

THE problem herein presented is a very common one, though none the less interesting on that account. The only uncommon feature — and a great relief it is, too, to one who has had some experience in such matters — is that there is no building committee to dictate the proper solution of the problem and to demonstrate how the building should be erected when designed. That being the case, I can arrange this church and its parish house as I like, considering nothing but the requirements of the case and the conditions imposed by the program. The obvious pity, at the start, is that there is not more space in this churchyard. The building will occupy about half of the entire space, and not allow as much clear ground about it as I should hope to see. However, that is part of the problem, and as "conditions" are a necessary feature of "problems," I shall proceed to explain my reasons for placing and for planning this building as I have.

The south wall of the church is placed near the lot line to enable me to get in enough space for the parish house on the north; and in the same way the eastern facade of both buildings is placed near that border of the property to give a proper amount of open space in front of the building where it is needed most. This compels us to have a short church; but by building the tower so that it will form part of the nave (and therefore lengthen the effect of the interior), that fault can be very largely concealed. In the same way, by carrying through the lines of the nave into the choir without a break (an arch), the same result is attained. The aisles are made wide to gain the seating capacity required. The south aisle is continued into the chapel. The corresponding space on the north side of the choir is taken up by the organ, with the choir and clergy vestries adjoining. The choir is made sufficiently large to insure ample space for the service as well as to give proper effect to the most important features of the building. The material for the exterior of this building has already been mentioned among the requirements of the program — "brick with terra-cotta trimmings." The brick should be dark red, laid in Flemish or English bond, with black headers and black mortar. The terra-cotta work would be either light or dark, depending on the effect desired. For the interior of the church we would have buff brick and light terra-cotta. The roofs should be dark oak, heavily trussed and open, as seen from below. The outside covering should be copper or lead. The floor of nave and aisles should be large tiles, and mosaic should be used in chapel and choir floors. The rood-wall of stone or terra-cotta, the rail of marble, and the altar, with its steps and platform, of marble.

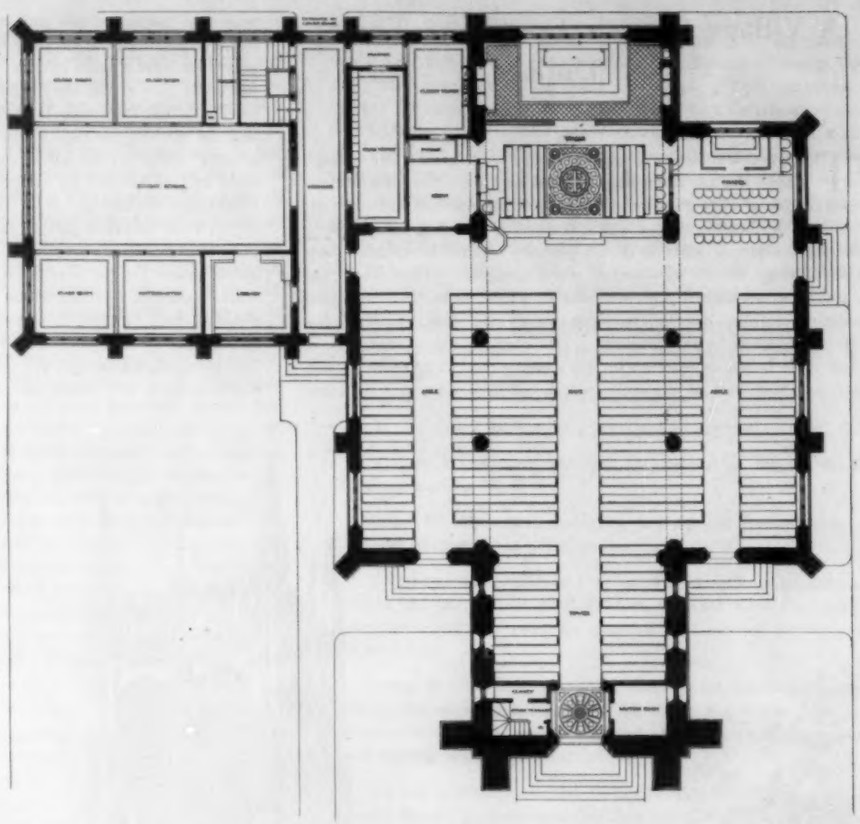
A second altar would be placed in the chapel, where daily services and early celebrations would be conducted. The congregation would pass out through the chapel from the choir after communing.

It has already been noted that the nave is carried into the tower, with only an arch to separate them. The western half of the tower on the main floor is occupied by the main entrance vestibule and by a waiting room. There is also a staircase here to the gallery above. The great west window above this gallery would be one of the striking features of the church and a most practical advantage at the same time.

A word might be added here about one of the peculiarities of this plan. While everything has been done to make the building appear as long and graceful as possible, it will be seen by examining the plan that all the seats, with a few exceptions, are confined to a perfect square, and that, as a rule, they are within 50 ft. of the pulpit and the lectern. Besides the main entrance by the west door in the tower, there are four smaller entrances to the church. In cold weather three of these would be used as exits only. The door to the parish house is intended to be used by the choir. The foregoing remarks seem to cover the principal features of the church. The parish house is the next factor to be considered. A wide corridor separates its principal rooms from the church. That by the east door is from the lower grade and the stairs to basement.

The central feature of this building is the Sunday-school room. Opening from it are the class rooms and the kindergarten room. These are separated by screens that can be partly removed when necessary. There would be other well lighted rooms on the basement floor besides the kitchen, store rooms, and lavatories that are required by the program, and which could be used as class rooms or for meetings of the committees that always form an important feature in the life of any well organized parish. The ceiling of the Sunday-school room would be as high as that of the aisle. Above the two vestries and connected by the staircase would be a room with opening into the choir, where sick or infirm persons could hear the service. Those in very deep mourning, or who for any other reason desired to see the service privately, could use this room as well. The style of this church and parish house is an adaptation of English Tudor Gothic to our own modern requirements, retaining the essentials of that style in their entirety, but adding certain properly recognized innovations that modern conditions of parish life and work require in the arrangement of the plan generally.

The effect of such a building can be relied upon to be imposing and eminently satisfying from every point of view. Furthermore, it stands as a link between the historical and emotional past and the practical life of the present day. It has none but the strongest reasons, both historical and practical, to recommend it in striking contrast with others, while its being the home of our mother church for so many generations makes it essentially the proper means of expressing our modern religious life and our historical continuity at one and the same time.



FIRST SKELETON CONSTRUCTION BUILDING.

EDITOR OF THE BRICKBUILDER:

Dear Sir: — In your correspondence column of the September number, a New York correspondent calls attention to the placing upon the Tower Building, 50 Broadway, New York, of a tablet to commemorate and establish for future time the record of erection of the first skeleton construction building of the United States. He incidentally remarks that a Chicago architect made a claim of priority, but that the *Record and Guide* gives abundant proof that the Tower Building, designed by Bradford L. Gilbert, is entitled to the honor. This is a question which has been raked over so often that it is a little strange to see in your columns a disregard of recorded structural achievements. The era of high buildings did not begin in 1870, as your correspondent states, but nearer 1884 or 1885, and Mr. W. L. B. Jenny has been so often acknowledged as the man who built the first complete skeleton construction in this country, the Home Life Building, Chicago, corner of Adams and La Salle Streets, that it certainly is not fair to neglect him in favor of the architect of the Tower Building. For that matter, it is a fact of record that the general scheme of skeleton construction was used by Mr. Post even earlier than this in the Produce Exchange in New York, and if we are going to ascribe to any one man an exclusive right of priority in an invention of this kind, which, after all, is a development rather than a spontaneous growth, it surely can hardly be given to Mr. Gilbert, excellent constructor as he is. It seems, on the whole, fairer to say that skeleton construction was a development of necessity, and that at about the same time several architects in New York, Chicago, and Minneapolis conceived and put into practical execution the idea of substituting steel columns for a brick wall, and that no one is entitled to all of the claim for this application.

Yours truly,

VERITAS.

The Artistic Possibilities in the Use of Roofing Tile. I.

BY W. A. OTIS.

THE constantly increasing use in this country during the past few years of tile as a roofing material has frequently been noted by casual writers with apparent surprise. To architects, however, its steady advance in favor is no wildly exciting piece of news, requiring broad or loud heralding.

This favor, with which it is now being received, is undoubtedly largely due to the very greatly improved material — as regards clay, workmanship, and fine mechanical construction — that has within recent years been generally put upon the market. It has also become a thoroughly accepted fact to the profession that satisfactory tile, while extremely economical in the long run, are not cheap as to first cost. As a result of such expense inferior materials have very naturally also been offered the public, and their use (oft-times forced), with the inevitable disappointing results, have tended to hinder more or less the great and general appreciation of what in its best estate is really a decided boon to the building public. But notwithstanding such occasional and deserved setbacks at points here and there, there has been, upon the whole, the very general and well-known advance of this material in popular favor.

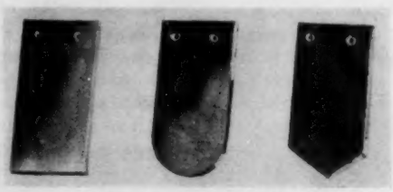


FIG. 1. TYPICAL FLAT SHINGLE TILE.

What was at first considered as a luxury has finally become a necessity, and now that it is no longer a novelty, but a well-established material, there is happily search and study going on here and there to seek out, if possible, more artistic methods of use.

Our earliest pioneers, so to speak, in the use of this material perforce contented themselves with the most simple of the tile,

FIG. 2. ELABORATE GUTTER MOLD.

known as the flat shingle tile, from the fact that its shape, form, and method of laying are supposedly patterned in a general way after the wood shingle. The simplest expression of this tile usually takes some of the forms shown in Fig. 1. With these simple shapes, moreover, the earlier architects had little or no choice as to color. Now, however, the possibilities are very widely extended. In fact, one is sometimes tempted to think almost too much so, but the possibilities are at hand; and one can only trust that the really strong inherent though frequently untrained artistic spirit of the American designer will not permit us to be led far astray.

A study of the continuous history of roofing tile, with all its ramifications, modifications, and variations in different countries and climates, under the influence of widely diversified kinds of clay, methods of fabrication, and national taste, is interesting and curious. It may also be of considerable practical utility to one who seeks models for new or unusual shapes and combinations of material; but a knowledge and consideration of the historical side does not necessarily have much to do with the tile offered us for sale to-day. What most architects and designers are interested in is the artistic possibility of the roofing tiles now in our own markets.

The primary and essential requisite of a roofing tile, it goes without saying, is, that it should effectually keep out wind and weather. No matter how striking and even beautiful it may be, if it does not do this, it is rightly a failure, both artistically and practically in American eyes, and no amount of mere good looks will gain it any lasting favor.

Again, it needs be remembered and especially impressed upon the mind — with about 40,000 or more horse power pressure — that what is entirely satisfactory, mechanically perfect, and adaptable to one kind of a roof (for instance, of very low pitch) is often not at all desirable or practicable for another kind (say a very high pitch roof). This point, the rational use of tile, is one that cannot be too strongly insisted upon. For architecture to be really and truly artistic, it absolutely must at the same time be rational also. Yet this often seems to be entirely overlooked and ignored: for instance, a real Southern, Spanish, or Italian tile is possibly well adapted to a low, almost flat roof in Florida or New Mexico, where there is no ice or driving snow; but to insist upon using this same tile at Montreal or Duluth, upon a roof which for all practical reasons ought to be steep, becomes worse than an absurdity.

Few of us fully realize the geographical magnitude of America, and while Europe with less variations of climate is divided into a number of nationalities, each conforming more or less in their architecture to climatic conditions, we, as yet, refuse almost absolutely to recognize this factor.

A wave of fashion, so called in architecture, sweeps over the land, and Romanesque or Italian Renaissance constructions, as the case may be, are frequently designed far from the site of the building erected, entirely regardless of the real exigencies of the case, — quite indiscriminately in New York and Las Vegas, in Winnipeg and Corpus Christi, — all the time the designers entirely ignoring the slight matter of climate, and the fact that, between the extremes of temperature at such different points, there may be over 150 degs. variations inside of twelve months.

This, to use a mild expression, is unfortunate when applied to buildings as a whole; but it is absolutely bad when applied to roofing tile. Consider again a little farther: the tile mentioned above, which in its native habitat, so to speak, is laid upon a very low pitched roof, upon slats, and held in place almost entirely by its own weight, when laid upon a roof of 60 degs. slope, and in an extremely cold climate, has to be placed unnaturally upon a solid roof board covering, then nailed and cemented, and finally pointed up, — all to get simply an effect that can no longer be really satisfactorily artistic since it is no longer practical, too.

Occasionally it is desirable for good and weighty reasons to follow with extraordinary accuracy, defects and all, some one of the historical styles, but this occurs extremely rarely, and should be very sharply distinguished from the logical following of style. It is in this latter method of treatment that the best known names in American architecture have become famous, and where may be distinguished their success

FIG. 3. SIMPLE GUTTER TERMINAL FOR TILE ROOFING.

FIG. 4. ORDINARY FLAT ROOF AT PISA, ITALY.

and others' failure. These brilliant lights of the profession have used these styles, — not defects and all; but with consummate judgment, retaining especially the general outline and also the ornamental detail with extraordinary fidelity, but modifying other features, and often essential elements; so that, while following the full spirit of the old work, they yet so modified it as to fulfil modern requirements and conditions, thereby accepting the best modern applications of science and progress.

In most of the architectural styles that originated in Southern and hot countries, the roof lines are generally of very minor importance · often practically flat and concealed behind some kind of a balustrade. They have absolutely no effect upon architectural design, or else, with a very low pitch, they are of minor importance in the scheme. Beyond the mere line of color and the ornamental treatment (as in the old Greek and Roman work) of the tile, or more properly the upper member of the cornice itself, where anthemion forms accentuated the lines of the tile, everything else is extremely simple; such gutter treatment may be and occasionally is quite elaborate, as indicated in Fig. 2, while Fig. 3 is very simple. But the far greater simplicity is in reality the type of the great majority of existing buildings of Italy, Spain, and southern France, as shown in Fig. 4.

FIG. 5. STEEP ROOF WITH TILE, NUREMBERG.

On the contrary, in those styles that were perfected in the more northern countries, there was always a tendency, arising from the desire and necessity of letting snow and ice slide off as soon as possible, to make the roof high and steep. As a result, these portions became of prime importance in the design, and their study and ornamentation to make a picturesque effect was always most evident. These high roofs one finds not merely in northern France, Germany, England, and Holland (Fig. 5), but likewise in a modified degree in Japan, northern China, etc. (Fig. 6).

Naturally these high, picturesque roofs offer the best field for the display of the roof covering, and here one finds some of the most interesting historical solutions of the artistic use of tile. As the greater portion of the United States follows northern European styles, these solutions may be of especial interest in pointing out paths yet capable of fuller development by our designers.

Historical study shows that there were in reality but about three main types of tile in use from the Greek down to the Gothic period, the balance being mere variations and modifications, and they often due to inferior workmanship and machinery, or lack of machinery.

These types have become classic, so to speak, in the history of tiles, and their modern reproduction has been demanded and required almost solely from a supposedly artistic reason, but, in reality, a largely sentimental one.

On the other hand, accurate modern scientific knowledge and improvements in machinery for manufacturing have especially here in America resulted in numerous modern forms, which seem to have in themselves great artistic possibilities, and are much more satisfactory for the climate and conditions of our Northern States at least than the so-called classic shapes.

And yet with all these and other aids (to be mentioned hereafter) in the hands of the architect, the great and varied possibilities in the artistic use of roofing tile are scarcely appreciated by the average practitioner. Moreover, he is often restrained from doing what he has an inclination to do by the fear that the result will be so unusual and striking as to cause marked comment, and probably uncomplimentary or sarcastic remarks, from the self-constituted critics, since the great superiority of any critic is always shown by his adverse opinion.

This is much to be regretted, since tiles and their treatment, whether upon the roof proper or upon the sides of the building, offer very many rational, natural, and desirable aids toward the artistic effect of a completed structure; but, as this is a move in an almost unknown field to the American public, the innovators must expect to have their work very severely and seriously handled. Consequently it is essential that any steps in this direction be taken only after very careful study, so that the designer may be absolutely sure the result is really thoroughly artistic, and that in the end it will surely come out victorious from the critic's attack.

To accomplish this, perhaps unusual study is required on the roof, since curiously enough contractors complain that if there is anything of the unstudied, the inaccurate, or the impractical in a whole set of plans, it is sure to be here; and the roof, according to them, rarely, if ever, receives its full quota of study. And yet this part is in the majority of buildings confessedly one of the most important features, and the one most latent with possibilities of success or failure to the whole scheme.

If these designers are to still further accentuate this feature, it should only be after most consummate study, and that this unfortunately is often lacking in attempts at the higher flights of tile usage is sadly apparent, when one looks over photographs of such work. These are often either frightfully commonplace and evidently about half studied or else preeminently vulgar.

Bearing in mind the points and generalizations enumerated, we may now consider the actual practical surroundings or limitations of

FIG. 6. PICTURESQUE HIGH ROOF, JAPAN.

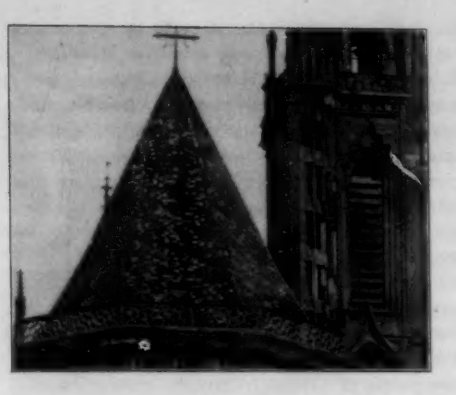


FIG. 7. APSE, ROOF OF CATHEDRAL, STRASBURG, WITH TILE OF UNEVEN COLOR.

the artistic uses of roofing tile.

In such consideration two points need be clearly borne in mind. First, that what applies to the roofs themselves applies also (although usually in a somewhat less pronounced degree) to this tile when occasionally used as covering of the sides or gables of buildings, and that the term "roofing" is here general in the broadest sense. Second, that in considering the tile, only a limited number of those upon our market are here illustrated, and that such illustrations (many from photographs furnished by the kindness of the representatives of various companies) are in no wise to be construed as anything but general or typical representations of certain types or features.

The artistic employment of tile, it appears, may very satisfactorily be grouped under three heads, as indicating in a general way the methods by which such artistic results may be obtained, viz.: First, by the color or combination of colors; second, by the shape of the tile themselves; and third, by the combination of tiles, either of same or different shapes, into groups or patterns. Examination shows that, as a matter of fact, none of these three methods are in any ways new, but have been more or less utilized by architects of all countries for many centuries, and are still full of possibilities for us.

The first one of these artistic forces put into the hands of the designer of the tile roof is then that of

COLOR.

For artistic results (especially with comparatively cheap material) every one recognizes that there is no such effective aid to the designer as color, and especially combinations of color. Its importance then with the great plain masses that go to form the covering of a building is almost self-evident.

Where tile roof is used, its size and usually brilliant effect, to a large extent, are apt to overpower every other portion of the design. Hence there is need of special care in the selection of that color itself, or, what amounts to almost the same thing, in the choice of that for remainder of building.

One cannot emphasize too strongly this matter of tint, for often upon it very largely depends the success of a design, without people being aware that such is the case.

To many persons, the name "tile roof" means nothing as far as color is concerned but a red. In fact, such is, and in a broad way always will be, the general and universal tint. As it is the natural color, so it will always be the stock color, but even this so-called natural shade is not by any means always the same, but varies considerably according to locality and material. The tile being manufactured in comparatively few places (at least up to the present time), the ones to be employed in ordinary work must be accepted in their natural color. This roof color, practically forced upon one, must then form the key note of the color scheme, and the brick may now be selected. One can here usually have several options as to shades, so that the result of roof and body of building shall form satisfactory harmony (or contrast).

As regards color schemes with tile, there are a few general considerations that it is well to keep in mind. Except in very rare cases it is unwise to try and make the tile and the brick of a building exactly the same color. In fact, for the most artistic results it is of almost vital importance that they should not be: the difference need not be great, but some difference is very essential. Again, it is a grave mistake from an artistic standpoint to require an absolutely even shade for the tile. From an economical standpoint it is also important, since the handling over and "selecting to color" means

FIG. 8. MIXED COLORS, PARK STABLE ROOF.

a considerable increase in the expense over an equally good grade of material that is simply "kiln run."

By the slight gradations of color as they occur in the manufacture, one naturally and inexpensively obtains that variation of light and shade which adds so very materially to the essentially artistic value of a building.

The flat, dead, absolutely even tone that one frequently sees throughout an entire building, indicating that with great care and expense the brick, terra-cotta trimmings, and the roof tile have all been specially selected as to the same identical color, is a lasting monument to a lost opportunity: a building that if worked out naturally might at least have had an artistic coloring now has about as much character as a piece of raw red liver.

FIG. 9. STRONGLY MARKED HORIZONTAL LINE IN TILE ON ROOF.

Fortunately, this artistic principle is again asserting itself and becoming better appreciated as well by the general public as the architects themselves: the false standard, which at one time had almost been forced upon the community by the curious idea that all fine brick (and consequently all clay work) should be of identical size and color, is being relegated to its proper position.

The old tile roofs of Europe, generally so beautiful and harmonious in color as to have often called forth praise from artists, both of word and of color painting, are types to be well considered. It is practically impossible to find one of them of even shade

FIG. 10. TILE WITH STRONG VERTICAL LINE.

throughout, and the variations add to the charming effect. Often these variations upon the same roof are extreme, and yet the result is invariably artistic. The apse roof of the cathedral of Strasburg is an example in point (Fig. 7).

In this usage, however, it is very essential that the tile should be laid with studied irregularity as to color, so that there may be no great blotches. A most effective example of this character is a roof on the Belle Isle Park stables (Fig. 8) near Detroit, where every shade manufactured by the tile company was said to have been used. Especially for picturesque work this method of treatment gives inexpensively most desirable results.

Thus far only the common red tile have been considered, but as a matter of fact the possibilities in other directions are almost without limit, and therein lie the great and perhaps the greatest possibilities of this material for the most artistic roofing.

In expensive or monumental buildings the economical argument as to standard colors becomes invalid, and there is no reason why special shades should not be manufactured, that will with especially good effect, and in the most satisfactory manner possible, prove both literally and figuratively the crowning glory of the composition. All the shades in which it is feasible to make brick and terra-cotta can naturally be duplicated when the necessary additional expense is not a serious consideration. Then the whole scale of tints becomes at once not only possible but wholly feasible, so that whether buildings be of brick or of stone there need be no difficulty whatever as to general and absolute harmony of effect.

So important is this matter of color that all other artistic possibilities in relation to the use of roofing tile become very minor affairs when compared with it.

Not merely are shades feasible in the ordinary brick tints mentioned and usually considered, but when the results of glazing and all its attendant hues and special effects are added the combinations simply become innumerable. Blue, green, yellow, black, white, and other equally surprising colors are perfectly within range. These violent colorings of roof with us have as yet been so little employed that both architects and clients seem to be almost entirely deterred from such uses by fear of public criticism, and yet in China, Japan, Siam, and other countries, specially of the Orient, these combinations are frequent and much admired.

FIG. 11. SHOWING VERTICAL, HORIZONTAL, AND DIAGONAL LINES OF TILES, DEPENDING UPON ANGLE OF VISION.

In Europe also their use (but there generally in combination with other colors) is frequent and extremely effective. Not merely is this seen in such important buildings as the cathedral at Vienna, but even in smaller constructions it is not unknown. However, it is rarely indeed entirely desirable to use such strong and exceptional colors in the solid mass, but rather as intimated, in patterns and designs upon a background of the more common red. They are thus extraordinarily effective, and deserve a much wider use than is now given them with us. Greens and yellows are the favorite colors used in combinations with reds and browns, and their beauties grow upon one the more familiar they become.

A moderate use of such combinations is especially to be desired, and the field open for a careful and conservative use of them is most attractive. At first the effect will quite probably be stigmatized by the great body of the people as "Dutchy," but the artistic qualities are so evident and self-apparent that it is a pity that courageous artists cannot more frequently be found to add to the effectiveness of their buildings these simple means so readily at hand.

With reasonable conservatism and a trained eye as to color the results cannot be doubtful. It is only an over-exuberance and a lack of color training that will lead to really serious and damaging criticism, or in any way impede the onward progress of the use of tile of this character.

But this is really not nearly so much to be feared as the ultra-conservatism which enforces the old and the commonplace. For instance, the very dark glazed so-called Spanish tile are, as a matter of fact, very difficult to form into a real harmony with many building materials, yet from the fact that the color itself is apparently so non-committal it happens that many dare to use it, but not by any means with results that with a wider range of color could not be very greatly bettered.

Thus in the matter of the color to be given the roof the opportunities with tile are almost limitless, and the finest artistic instinct can find a field for study, while with such vast facilities nothing need be crude or harsh.

Having once determined the scheme of color, the other expedients to aid in artistic results may be most naturally considered, and first would be that of the

FIG. 12. SHOWING SMOOTH EFFECT OF FLAT SHINGLE TILE WITH ENTIRELY HORIZONTAL LINES.

SHAPE OF TILE.

While the general and broad effect of color of a roof will, of course, be obtained from the tint of the tiles themselves, yet the minor and finer delicacies of shades and high light, which really add so very much to the artistic result, must be gained almost entirely by the shape of each individual tile going to form the great mass.

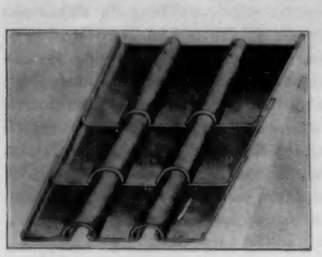


FIG. 13. ROMAN TYPE OF ROOF TILE.

From the pattern selected will result, as a matter of course, the prominence (or the total absence) of strong lines in this roof covering. As all observers are aware, these are, after the color itself, one of the great beauties of tile roofing, and it is their presence which gives so much character to many of the historical patterns. Also, it is to this possibility of strong lines that the most artistic work must eventually give prestige and preference, when the roof covering is selected.

In this connection it goes without saying that the mechanical perfection of laying is of vital importance. To have crooked or broken lines will always be a blemish. From whatever direction one looks at them they should be sharp, clear, and straight. Figs. 9, 10, 11, 12 show the beauties of different kinds of lines. In No. 12 there is the very smooth effect with scarcely appreciable horizontal lines, as produced with old-fashioned flat shingle tile.

In Fig. No. 9 there is a strongly marked horizontal line with secondary broken vertical lines; in Fig. 10 the strong vertical line; and in Fig. 11 a tile where the vertical, horizontal, and diagonal line becomes pronounced, depending upon the direction from which it is seen and the angle of the roof.

This possibility of variety dependent upon position, etc., is especially strongly marked in some of the modern forms of tile, and is a strong artistic argument in their favor.

The shapes of roofing tile are (or can be) extremely numerous. There are first what may be called the historical shapes — forms of tile that have been used in different countries and in different periods. They would include examples from not only Assyria, Greece, Rome, and all modern countries, but also from Persia and the Orient.

Then there are the more modern types of tile, capable of being molded by machinery, and which have been largely developed within comparatively recent times, mainly in Germany and France, and latterly in this country itself.

The sum total of all these is extremely large, but quite outside the present question under consideration.

Of the numerous varieties and kinds of tile in our markets, each must have at least *some* good points, but this is not the time to consider the advantages or disadvantages of glazed or non-glazed tile, or the superiority of one style of patent interlocking joint over that of some competitor, or whether all interlocking joints are a snare and delusion. Suffice it then to consider them almost exclusively from the side of the artistic possibilities, although most practitioners have ideas of their own upon the merits and demerits of different makes.

A few of the "classic" shapes, like Fig. 13, hallowed by age, are now upon the market. But the mass of material offered for sale is of the more modern type.

The practical difficulties from the maker's standpoint in many of the historical shapes are apparently twofold: First, they are essentially hand-made shapes, and as yet but little machinery has been invented that can *advantageously* reproduce these. Second, as a matter of fact, like many ancient and medieval products, the conditions to be fulfilled were by no means as severe as present requirements. Thus a small leak here and there was in reality rarely a matter of great importance.

Brick and Marble in the Middle Ages.

BY G. EDMUND STREET.

CHAPTER XI. — *Concluded.*

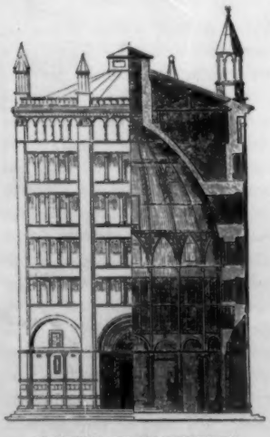
[The illustrations A, B, C, and D are not taken from Mr. Street's work, but are added as additional illustrations of the Italian brickwork.— EDS.]

THE Academy of the Fine Arts will be visited by every one who cares for Francia, and by many who fancy they care for the Caracci. As one of the former class, I recommend it very heartily. It contains a large collection, gathered in papal times from

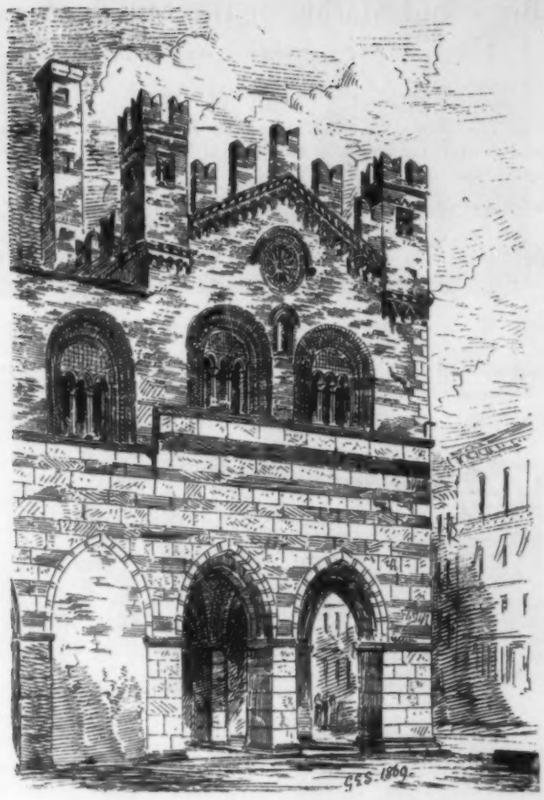
DUOMO, MODENA.

convents and churches, and mainly by painters of the Bolognese school. This school has the redeeming virtue of counting Francia on its list of painters, which may atone for much. He is seen here to advantage; and one trio, consisting of two of his pictures on either side of one of Perugino's, forms the noblest group in the gallery. Here one sees how much in common the two men had in spite of Francia's more forcible character. The same love of pure and rich colour, the same well-defined grouping, the same religious feeling mark them both. And never, I think, has the Madonna — pensive, lowly, and simple — been more beautifully represented than here by Francia. It is a face that one hopes to remember. Here, too, is Raffaelle's S. Cecilia, no doubt a very great work, but not great quite in the sense one wishes to understand the word at his hand. S. Cecilia and S. John are very fine, but S. Paul is a sort of burly ruffian. The heavenly choir is very mundane, and the whole work somewhat academical in its design and treatment. The earlier pictures here are very disappointing. The early Bolognese painters seem to have painted coarsely and heavily, and to have drawn badly, and there is no comparison for a moment between their work and that of the early Sienese and Florentine painters on the one hand, and those of Padua and Verona on the other. One has indeed in their works a sort of foretaste of what one has from their followers — the Caracci,

PLAN OF BAPTISTERY.



SECTION OF BAPTISTERY.



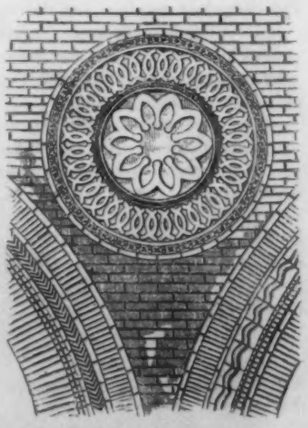
PALAZZO PUBLICO, PIACENZA.

Domenichino, Bagna-Cavallo, and to some extent Guido. Dismal colour, great striving after chiaroscuro, violent and distorted attitudes, and a purely conventional and academical style, are not great recommendations of any school, but they are things which must be accepted if one is to enjoy these works at all heartily.

A very short railway journey takes one from Bologna to Modena. The one object of interest here is the cathedral, but this is a building of extreme historical and architectural value, and has fortunately been left with so few alterations that we can make out its history with fair certainty. At Bologna everything was built of brick — here at a short distance we find our eyes rejoicing again in the sight of stone and marble.

The ground-plan of the cathedral consists of a nave with aisles terminated at the east end by three semicircular apses. There are a sacristy on the north of the choir-aisle, and a tower to the north of this. There are two doorways on the south side, three at the west end, and one on the north side. A grand crypt with arches on slender shafts occupies the whole space under the eastern part of the church. The access to the choir from the nave is by stairs against the aisle walls in the same position as at San Zenone, Verona. Here the stairs and their handrails are not later than the thirteenth century, and the choir is divided from the aisles by screens of the same age; solid below, and with a continuous cornice carried on coupled shafts above. The cathedral is said to have been founded in 1099, but an inscription on the south wall gives the date of the consecration of the building by Pope Lucius III. in July, 1184. I believe that the former date represents the age of the plan, and of most of the interior columns and arches still remaining, but that before the later date the whole exterior of the cathedral had been modified, and the groining added inside. The work of both periods is extremely good and characteristic. The columns of the nave are alternately great piers and smaller circular columns of red marble. The great piers carry cross arches between the groining bays, and each of these in the nave is equal to two of those in the aisles. The capitals here are very close imitations of Classical work, with the abaci frequently concave on plan. The main arches and the triforium openings of three lights above them are seen both in the nave and aisle, the vaulting of the latter being unusually raised. There is also a plain clerestory, and the vaults are now everywhere quadripartite. The outside elevation of the side walls is very interesting. Here we seem to have the old aisle wall with its eaves-arcade added to and raised in the twelfth century, and adorned with a fine deep arcade in each bay, inclosed under round arches, which are carried on half columns in front of the buttresses or pilasters. These arches show exactly what the original intention was at Ferrara, where it will be recollected they still in part remain. Certainly they would have made the side walls very rich in their effect, even if there had not also been two porches, a projecting pulpit, and various bas-reliefs inserted in them.

All the doorways deserve special mention. The eastern of the two on the south side, with the porch of two stages in front of it, is remarkable for the extreme skill and delicacy of its enrichment. The shafts are of white marble, and the mouldings which separate them of red, while the former are all carved in the most delicate manner. The porch is mainly built of red marble, and is carried on detached shafts, cut out of one block knotted together and resting on lions. The whole of this work is evidently an addition to the aisle, and dates from about A. D. 1180. The other doorway on the same side may probably be a work of the original foundation in 1099. It has the twelve Apostles on the jambs, and rude shafts carrying a canopy in front of it. The west doorway has also a porch, and sculptures of the twelve months on its jambs. It is covered with carving of foliage and figures executed by the same Wiligelmus who was employed on the western doorway of San Zenone, Verona. Among other figures are those of King Arthur and his knights, inscribed with his name,[1] "Artus de Bretania," above his head. The west front is very remarkable. The ends of the aisles have two arches inclosing small arcades similar to those in the bays of the side walls, and the end of the nave has the same arcade on each side of a porch of two stages in height, the lower of which is carried on detached shafts resting on lions' backs. The upper part of the porch was altered in order that a great wheel window might be inserted, sometime in the fourteenth century.



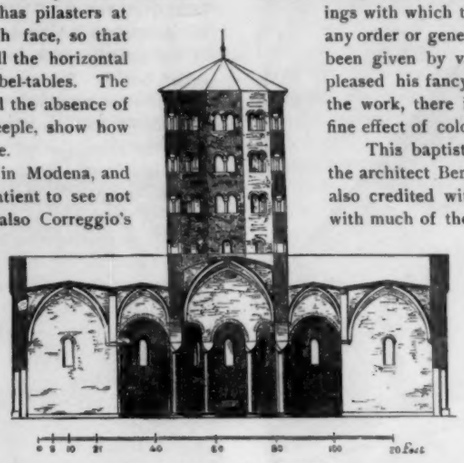
BRICKWORK, PALAZZO PUBLICO, PIACENZA.

This rose window fills the whole upper part of the western gable, and is, like many Italian examples, very unskilful in its design. The vast number of divisions or spokes, and the very slight prominence of the arcuated part of the filling-in, make it look in very truth a wheel window and nothing better. Above it are an insignificant figure of Our Lord and the Emblems of the four Evangelists sculptured in low relief. The lower portion of the walls is covered in the most promiscuous manner with bas-reliefs, and a medley of mural tablets, the number of which would delight the eyes of an English parish clerk; but nevertheless the rich character given to the work by the fine

[1] Mr. Perkins, 'Italian Sculptors,' p. 251, says that the nationality of Wiligelmus has been much disputed. Kreuser says that he came from Nürnberg; and the representation of King Arthur's victories over the Visigoths is adduced as a proof that he was not an Italian.

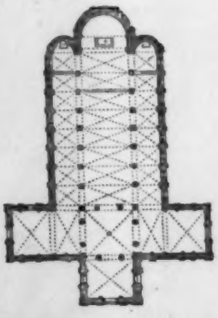
shadows of the arcades in the lower half of the front, is worthy of special notice and recollection. The tower and spire are very lofty. The former has six stages of nearly equal height, all round-arched, and on the top of this two octagonal stages crowned with a modern spire. The lower stage of the octagon is old, and was finished in 1317 by Enrico da Campione, one of the family of architects of whom I have before spoken. The tower has pilasters at the angles, and two intermediate on each face, so that there is a triple division in elevation, and all the horizontal string-courses are marked by arched corbel-tables. The repetition of these very simple features, and the absence of all openings in the lower part of the steeple, show how simple the elements of a good work may be.

I found nothing else of any interest in Modena, and made my way from thence to Parma, impatient to see not only the cathedral and the baptistery, but also Correggio's treatment of the decoration of the former. In spite of the great fame of these works, I fear I must at once confess that they took away most of the pleasure which I had anticipated from my visit to the cathedral at Parma. This is a grand Lombard church, fairly perfect in its architectural details and arrangements, but entirely ruined in its architectural effect by the frescoes with which most of its walls and roof have been covered. These have been painted without the slightest thought of the requirements of the building, and as a matter of course they have entirely ruined its effect. The frescoes in the dome are by Correggio, and are amongst his most celebrated works. Like all the rest of the paintings here, they present, when regarded from below without the assistance of a glass, a confused mass of distorted figures and limbs, not at all relieved by the dark and dismal colouring in which they are executed, and which doubtless is not what it once was. It is true that when examined in detail, and still more when examined in Toschi's careful engravings, they are full of beautiful drawing and skilful chiaroscuro, but the impression they have left on my mind is mainly one of the extreme risk of attempting to decorate a building without previous training in and knowledge of the requirements of architecture. As an example of Lombard architecture the cathedral at Parma is almost ruined, whilst it would be difficult to conceive a worse-fitted building for the display of Correggio's fancy and skill. The ill-assorted union, in itself ruinous to both, has been aggravated by the bad state of repair which has damaged and no doubt altered the colour of the frescoes; and the impression now produced is that of simply the gloomiest interior in Italy.



SECTION, SANT' ANTONINO.

The church is cruciform, with a central cupola and apses to the three eastern arms of the cross. The nave and aisles of seven bays are vaulted, and there is a large and striking crypt under the whole eastern part of the church which goes far to redeem its otherwise barren character. The effect here is remarkable, owing to the complex perspective and great number of single slender marble shafts carrying the vaulted roofs, and in part also to its unusual height. The capitals are all carved — frequently with coarse volutes; the church was founded in 1058, and no doubt this crypt is of about that age.



PLAN, SANT' ANTONINO.

Very near to the cathedral on the south-west is the now much more interesting baptistery. This is on the exterior a large and lofty octangular building, adorned in a succession of stages by small detached shafts carrying the cornices and strings which divide the elevation. Internally the scheme is very different. The eight-sided interior is subdivided, so that sixteen shallow apses are set around the inside face of the walls. These are separated by columns, and above them on each side are two stages in height, each subdivided into three divisions, which are again subdivided by smaller columns. A great vault or cupola covers the whole, and from its height gives an air of solemnity to the interior. It seems never to have been treated as a real dome, being covered with a flat roof, resting on the external walls, which are carried up far above the vault. The paintings with which the walls are covered are arranged without any order or general scheme of design. They seem to have been given by various donors, and each gave what best pleased his fancy; but owing to the early date of most of the work, there is in parts — especially in the vault — a fine effect of colour.

This baptistery is said to have been commenced by the architect Benedetto di Antelamo in A. D. 1196,[1] who is also credited with many other works here, and specially with much of the early sculpture in the Duomo and baptistery; it was not completed until 1260.

There are three great doors to the baptistery. On the northern is sculptured the Tree of Life, and over this twelve prophets carrying medallions with half figures of the Apostles. Below are subjects from the lives of Our Lord and S. John Baptist. The western door has a sculpture of the Last Judgment, and the southern a not very intelligible, though no doubt symbolical, figure of a man seated in a tree and gathering honey. Inside there are various sculptures, and among them a series of illustrations of the labours of the months.

My day in Parma was pleasantly concluded with a visit to the Gallery, and then, finding no more mediæval remains, I pushed on to Piacenza.

This is a city of no small interest, and remarkable above everything else in the possession of a Palazzo Publico of unusual and striking design — a building of special value and interest to me, since it is a capital example of the use of brick and marble together. Before looking at any of the churches I devoted myself to this building with the more satisfaction when I found that it was really, in some respects, one of the very best works of the sort that I had ever seen.

An inscription carved under a banner on a square stone, in the front, records the commencement of the work in 1281, and I think we may assume that no part of it is of much later date than this. It consists, as do most of these buildings, of a lofty open ground story, and a principal story above this. The façade is very dignified in effect. On the ground level are five lofty arches, very slightly moulded, and resting on square piers just rounded at the corners. The material of this stage is marble, mainly white, but with just a line of red and another of grey near the string-course which divides this from the next stage. From this point up almost the whole work is executed in brickwork of very elaborate and delicate detail. The two stages have no kind of uniformity or connection with each other, six windows being arranged above the five arches. In the centre of the first floor is the old doorway to the Ringhiera (which was altered in the seventeenth century); the windows on each side are of three lights, inclosed under a round arch with a deep archivolt very slightly recessed — all the enrichments being on very nearly the same face as the wall. These windows agree in size, but vary very much in all their details. Some of the subordinate arches are pointed, some round, and the tympana are everywhere filled with fine brick diapers. Above this stage the walls finish with a good marble

[1] The inscription on the north door is as follows: —

"Bis binis demptis. Annis de mille ducentis
Incepit dictus, opus hoc sculptor Benedictus."

cornice of intersecting arches, and then with a forked battlement. At the four angles of this are raised turrets, and the ends are finished with battlemented gables, very quaint and picturesque, as

(A) PALAZZO FABBIA DRA PALLAVICINI, BOLOGNA.

will be seen by the illustration which I give. The niches between the two arches in the principal story seem to have been intended for paintings. The marbles used here are red and white. Red is used for the arcades under the cornices, for the middle order of the rose window, and the inner order of the main arches. Elsewhere the marble is white, except the one grey course below the principal string. The whole of the lower stage is open below on all sides and groined — in brick, I think — though it is now plastered; indeed, save the parts already described as being of marble in the principal fronts, the whole of this building is built of red brick. Behind the open ground story there remains a portion of an internal quadrangle, which, incomplete as it is, shows, nevertheless, the same delicate attention to detail which is conspicuous on the façades. I know hardly any detail of Italian brickwork which is so refined and good as that in the arches and some cusped circles between them in this quadrangle.

I have seen this building, full as it is of eccentric departures from ordinary rules and customs — piers being placed over openings, and round and pointed arches used indifferently — quoted for our benefit as a remarkable example of a public building erected in the Middle Ages in the most regular and formal fashion! It is, on the contrary, if the plain truth is to be spoken, an example of a very bold disregard of such fashions indulged in without any detrimental effect.

Piacenza cannot boast of any very fine churches. They have been much ruined internally by modern alterations, and externally they do not seem ever to have been very attractive. The cathedral is a Lombard church of fine size, and with some good points. There are three western porches of two stages in height, according to the usual Lombard fashion. The doors are rudely sculptured; that in the centre with the signs of the Zodiac, and the northern door with the Annunciation, Salutation, and other subjects on its lintel. The columns rest on monsters, griffins, and men. The whole front is now finished with one large low-pitched gable, which has an arcade stepped up to suit its cornice. This is, however, a fourteenth-century alteration of the older church, as is also a rose window in the centre. A brick tower of late date rises at the north-west angle of the church, and is finished with a circular spire built of round-ended bricks. The external walls of the Lombard church were all built of stone or marble with shallow buttresses; the windows were very simple, and the effect was mainly due to the fine open arcade below the eaves, carried now on shafts, now on figures. The north-east view is very picturesque, owing to the number of angles and apsidal terminations which are seen together. These are produced by a plan of most unusual character, the transepts as well as the choir being finished with three apses, and an octagonal brick lantern rising out of the centre. Internally the cathedral, in spite of alterations, is still very interesting. The nave opens with eight arches to the aisles and transepts; but the three arches which open to the latter are much loftier than the five western arches, so as to allow of the transepts opening to the nave to nearly its full height. The groining of the nave is divided into three bays of sexpartite vaults — each bay being equal to two bays of the aisles, and there is a lantern over the two eastern bays. The transepts and aisles have quadripartite vaulting.

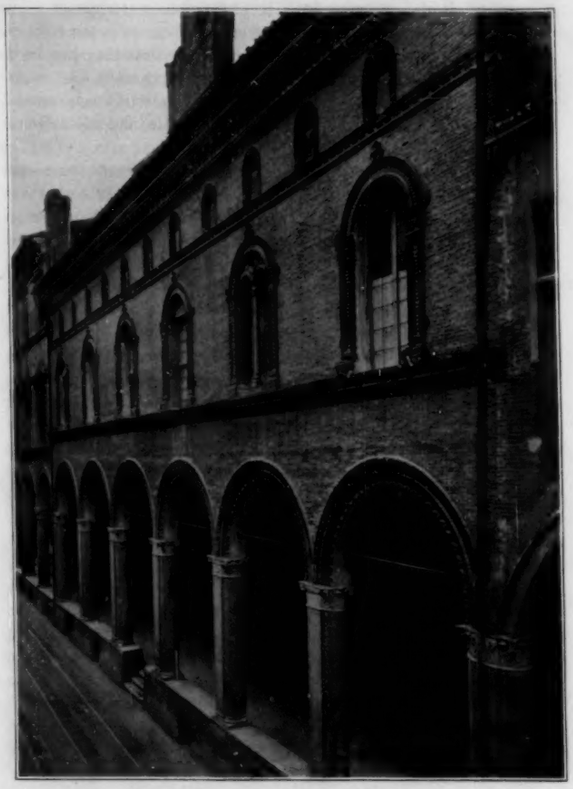
Under the choir is a crypt of great interest and beauty, owing to the vast number of delicate columns which carry the vault. It is

(B) INTERIOR OF CATHEDRAL, MODENA.

planned on a cruciform arrangement, with the principal altar in an octagonal central compartment. Here the priest celebrates on the eastern side with his back to the choir stalls in the apse, and his face toward the west. The access to this crypt is by two staircases at its south-west and north-west angles.

The large brick church of San Francesco is of the fourteenth century; it is very simple, but not striking in effect. The east end has been planned irregularly — to suit the site, no doubt — with an apse and aisle round it, and irregularly shaped chapels beyond the apse. The effect is bad, owing to the unskilful way in which the work has been done. The west front has the favourite sham gable adorned with circular windows, some of which are absolutely above the roofs of the aisles! San Giovanni in Canale is another church which has nothing of interest, save a few remnants of old brickwork.

Sant' Antonino is a remarkable church, hopelessly modernized with plaster enrichments. Like the cathedral, it has a lantern in the

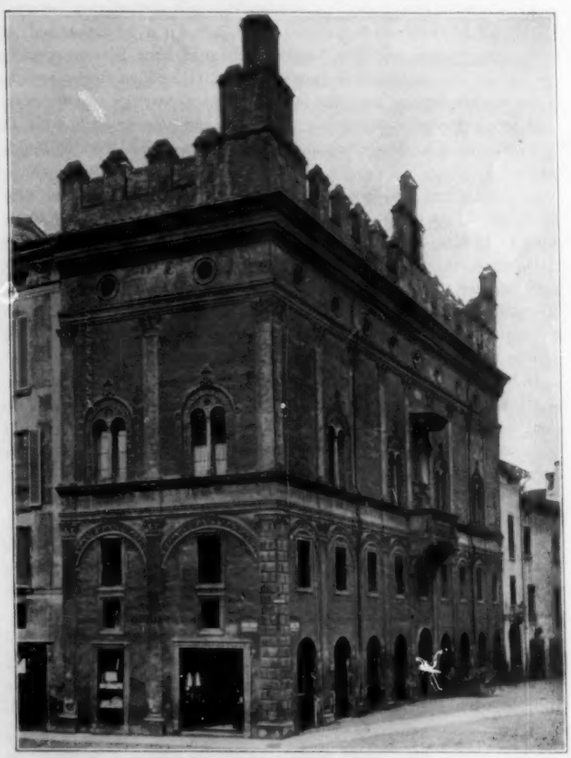


(C) PALAZZO FAVA, BOLOGNA.

centre crossing, carried on eight columns from the ground, which produce internally a very new and really striking effect. The lantern is finished above the roof with three stages, each of which is lighted with a two-light window in each face. There is a fine early marble doorway to the north transept, with men and monsters supporting the shafts, and some delicate carving. In front of this, at the end of the fourteenth century, was built a lofty porch with a great open archway to the north. It is finished with brick pinnacles and cornices, and is higher than the transept. The hinges on the west door here are very good, and the windows in the aisles — lancets with seven cusps in the head — are quite worth notice. Piacenza struck me, both in its churches and Palazzo Publico, as a town which had possessed a very distinctly developed school of architecture of its own. The churches are peculiar, not to say eccentric, in their planning, and the Palazzo Publico is quite unique in its design and general treatment.

The only other old work I noticed here was a house in the Strada San Marco. This is all of brick, and has arches of slightly horse-shoe shape. The bricks are all axed on the face, and are of large size — 11¼ inches long by about 2¾ inches high.

Not very far to the east of Piacenza is Asti, a dull city, distinguished, however, by some remarkable features in its churches. The most important of these are the Cathedral and San Secondo. They are extremely similar in general design: they have naves with short choirs, transepts, low octagonal vaulted lanterns over the crossing, and apsidal chapels in front of the transept gables, and at San Secondo to the several bays of the aisle. Their towers are on the east side of the transepts. The peculiar feature of their detail is the very elaborate way in which brick and stone are counterchanged in the jambs and arches of windows and doorways. The moulded members of a jamb are alternately of brick and stone, and in each course stone comes above the brick of the courses below. San Secondo cannot, I think, be earlier than circa 1400, but at first sight looks like a building of 1200. The cathedral is probably somewhat though not very much earlier. Its plan was evidently derived from that of the cathedral at Piacenza. Its proportions are bad, and it is only redeemed by the picturesqueness of some of its details. Another church has an octagonal campanile; and another, one of sixteen sides. This is of brick, except the upper stage, which is coursed in brick and stone. Its sixteen sides have alternately a window and a shaft running up to the cornice, and in the stage below it there are eight windows below the shafted sides of the belfry. The composition of this tower is certainly very good.



(D) PALAZZO MALAGUTI GIA DELL' ARTE DEGLI STRAZZAROLI, BOLOGNA.

Another fine lofty tower with bold cornice and Ghibelline parapet recalls the Veronese towers to mind, and there are besides not a few remains of mediæval domestic work, so that a day may be well spent at Asti by an architect.

(*Continued.*)

Fire-proofing.

FIRE-PROOF CONSTRUCTION OF BUILDINGS IN THE UNITED STATES.

BY R. W. GIBSON (NEW YORK).

(Read before the Royal Institute of British Architects.)

FIRE-PROOF construction has been encouraged and developed in the United States more rapidly than in other countries: first, because of the vast amount of new work continually undertaken in the development of new cities, from which the evolution of improvements is natural; and, secondly, because of the growing danger and actual loss from gigantic conflagration which the dry continental climate has caused in cities constructed of combustible material. The long-recognized superiority of brick walls, of course, induced their use to some extent even in the earliest colonial days, and in places where at this time wooden construction prevails, because of its economical and hygienic desirability. The house or business building with brick walls and slate roof was valued, as compared with wooden buildings, chiefly for its fire-resisting qualities; but, with the growth of city buildings into crowded streets, and upwards many stories above them, it was soon recognized that this external casing of incombustible material gave in such a situation only a temporary respite, and that, before the heat of such fires as actually broke out, the combustible interior, with its wooden floors resting upon timber beams and divided by wooden partitions and doors, and stocked with combustible furniture and stores, made fires as hot and almost as dangerous and rapid as the original wooden buildings.

The ancient building methods of some southern peoples who preferred floors of masonwork, which, though usually resting upon wooden beams, completely incased them in brick and plaster materials, came into use to some extent in America in colonial times, and their superiority in fire-resisting qualities was soon noticed and afforded a practical lesson. Portions of buildings were constructed in this manner, such as halls and corridors in hotels, and their greater safety was appreciated so much as to impel further development of the idea. The increase in height and size of buildings was at the same time compelling a more liberal use of iron, and, later, of steel, in their construction, and the first efforts at fire-proof building were somewhat disappointing, because of a lack of perception of the difference between incombustible materials and fire proof materials. It was soon perceived that although iron is, under ordinary conditions, incombustible, it was very far from being proof against injury from fire of even moderate proportions; while, on the other hand, the small injury done to heavy timbering in the early stages of fire led to some excess of apology for its combustibility and efforts to continue its use. There were and still are many advocates of the use of timber in very massive scantlings who show with much truth that it takes longer to impair the strength of floors and pillars of this kind than it does those of unprotected iron. Yet very large conflagrations have proved that after all it is only a question of a limit to be passed when the massiveness of the timber becomes a horrible addition to the quantity of fuel. It may be safely asserted that the days of slow-burning wooden construction are numbered, so far as concerns large cities, although possibly rural factories, where economy of construction can be partly counterbalanced by an extra organization of fire-extinguishing machinery, and where the destruction of one building does not necessarily imperil any others, may advantageously use these methods for a long time to come.

At the same time, the exposed iron systems, even when the combustible materials were reduced almost to nothing, have failed signally, because the heat generated by the burning of fittings and furniture and stored goods is sufficient in even the mildest cases to destroy the strength of iron.

The modern system of fire-proofing has been developed from these experiences upon the still older patterns afforded in the old floors with beams buried in masonwork, the modern work using steel and iron instead of wood, and perfecting and systematizing fire-proof protection. Its latest and present phase is the final elimination of the last of the combustible materials tolerated now in fittings and finishings, such as doors, floors, architraves, etc. The principle insisted upon is vital, and is really the first one, viz., the absolute disuse of combustible material in the construction of the building and in its fitting and furnishing. The second principle, also now well recognized, is the selection from incombustible materials of those which are also fire-resisting, and the use of these to protect others which are not and which must not be used unless they can be so protected, because the use of the building will generally lead to the introduction of some combustibles into it as materials to be stored, or as materials to be used in business or daily life, and these cannot be eliminated.

The materials most available for the fulfilment of these conditions at the present day are steel or iron, and brick or terra-cotta and plaster,—the metal for the reception and transmission of chief strains, and the terra-cotta and plaster for the clothing and protection of the metal.

The manner of using the steel and iron may be regarded as a question of construction, since it must now be admitted that steel and iron have little or no power of fire resistance. The true fire-proofing lies in the use of a limited number of masonry materials, for it must not be overlooked that many non-combustible materials, even in masonry, are still as unreliable as the unprotected ironwork; some granites, for example, and marbles could be and have been wrought into strong and handsome staircases, with metal strings, and beams, and treads of stone, which are shattered and destroyed in the earliest blasts of a severe fire. It may be noted here that not only the intense heat, but a variation of heat, must be considered, and the destructive effect of torrents of cold water thrown upon substances raised to a white heat. Such a structure is non-combustible, but not fire-proof, and it is a good example of what is meant in this distinction. Such materials may be used where their strength is not relied upon, as in wainscotings, or where they are protected: for example, if the staircase just referred to had all its iron incased in terra-cotta, and its stone steps protected by terra-cotta, or plastered soffits, it could then be called a fire-proof staircase.

In selecting materials for the fire-proofing of others, regard must be had, not only to the destruction caused by fire, but also to injury likely to arise from the general use of the building, such as the blows and scrapes likely to be received by a column in a warehouse; and in this connection a curious but very important qualification, demanded in connection with high buildings and modern city life, is that the fire proofing must be such that, when the fire occurs, it will not be washed off by the terrific waterspouts turned upon it with modern engines. Some fire-proofing, otherwise good, has failed altogether because the water from high-pressure engines disintegrated it and tore it off.

Those most interested in fire-proof buildings, such as underwriters and fire insurance companies, recognize fully the necessity of distinction between the several classes of fire-proofing; and it is a fact that insurance rates are now adjusted according to the detailed construction of the building, instead of, as formerly, upon the broad claim that it was a fire-proof building based simply upon the possession of an incombustible floor structure. The time has now come when a sufficient series of experiences has justified the holding of definite views in comparing various materials one with another. The sum of all these experiences indicates clearly the superiority of fire-resisting terra-cotta. It is one of the oldest materials used for this purpose, and has undergone many trials, and has always well performed the duty required of it, unless misapplied or imperfectly or

unfairly used. The scientific valuation thus reached is confirmed by the practical tests of an open market; an overwhelming proportion, probably 95 per cent., of the fire-proof floor work in use is of terra-cotta construction. It will be well, therefore, to describe in detail this generally accepted method. First, however, an explanatory description of the structural ironwork of the building is desirable. This may be divided into three classes, suited to as many types of fire-proof buildings. First, the building which, being of ten stories or less, is erected by the old methods of supporting walls and superimposed columns carrying floors and roof, and with only small beams and girders, or occasional independent trusses. Secondly, the building which, being of more than ten stories in height, accumulates such strains upon its walls that they must be reinforced by posts to carry the girder loads, and in which the walls require such mass in their lower parts to support their own upper parts that the metal first introduced to support the floor girders is reinforced and called upon to support the upper walls; becoming, in fact, a framing of vertical posts and horizontal girders, into which the wall is built in a series of panels of one, two, or three stories in height. This is so-called skeleton construction. When the height exceeds twelve stories, or when exposure to wind and other strains is great even at this height, the ordinary attachment of columns and girders is abandoned, and horizontal stability, no longer secured by the mass of masonry walls, is supplied by rigid riveting of all connections of posts one upon the other, and of girders to posts, and beams to girders, and by the addition of bracing in ties and struts and gusset brackets; and thus is developed the final so-called cage construction, wherein the steel receives and transmits all loads to the foundations; and the walls have become mere panels, not only without vertical loads, but without transverse bracing strains. Thirdly, an intermediate type of building has arisen, where all the internal structure and all the floor loads are supported upon columns, some of which are placed in the outside walls, but the outside walls themselves are made of self-supporting thicknesses in cases where architectural treatment demands sufficient mass for this purpose, and where the foundation presents no difficulty.

This classification is, of course, structural. Any one of these three classes of buildings may be finished in different degrees of fire-proof perfection; which will now be considered, commencing with a study of the highest class (of the third type) of construction, since it must be allowed that the massive walls are of value in resistance to fire as well as in affording stability. In a building of this class, erected for business purposes, perhaps in the form of offices for a large corporation, with many stories to be rented to tenants, there have been achieved to-day almost perfect fire-proof qualities, although few of these buildings are so rigid in their exclusion of wood as to be ideal in this direction. Yet it can be asserted that there is at no time any danger to life from fire in such buildings, nor is there any danger, with reasonable promptness, of the fire spreading from the room from which it first occurs, even though that room may be full of combustible office furniture, and may develop heat to an extreme degree. This type of building has become systematized by custom and experience, so that its structure is similar and uniform throughout the country; and this not because of building laws or other regulations, but in spite of them, since these vary greatly in different localities, and have usually been amended in fragmentary fashion to meet and treat with the new methods of design forced upon them. In New York City this is notably the case; an old building law, framed before building steel was invented, has had a few sections interpolated to regulate fire-proof building; and again, at a later day, a few sections more to regulate skeleton and cage construction; the imperfection of the result is such that the new charter for the greater city recently incorporated contemplates the appointment of a commission for the complete reconstruction of the building laws. We may therefore dismiss all reference to fire-proof construction in municipal laws as being of little value in the present discussion, because these laws follow, instead of leading, the practise of the best architects and engineers of the day. Some of the more recently amended laws may be quoted as codifications of opinion to their date, and as such may be of some value in presenting facts in tabulated form. Referring, then, to the national practise rather than to any laws, this type may be best described by quoting the specifications which have been used for the erection of an actual building.[1] In this building all the fire-proofing is effected with terra-cotta, the exception being some portions of ceiling work and girder covering. The floor loads are supported upon columns of rectangular shapes of rolled steel, the outer columns being set in the outer walls in grooves, close fitting but without bond, so as to permit of unequal movements and settlements and contraction. The girders are of rolled steel, built and riveted for large sizes, and of I-beams for smaller sizes (24 ins. and under), and are all riveted to the side columns, so that these may be continued right through the height of the building in practically one length. The bracing is done with gusset plates and angles. The beams supporting the floors are small rolled steel I-beams, laid out to what has become a standard distance apart, viz., 4½ ft., and of what has become a standard of economy in size, viz., 8 or 9 ins.

This size and spacing arise from the use of the terra-cotta arch, of from 8 to 10 ins. in thickness, which is, theoretically, good for ordinary office building loads up to a span of 5½ or 6 ft., and practically and thoroughly good and reliable up to spans of 5 ft., with sufficient factor of safety to permit of such cutting as may afterwards be necessary for the insertion of pipes, wires, etc. Many experimental tests have been made with these floor arches, with greatly varying results. They have been built with spans 7 or 8 ft., and have endured tests at these spans for very great loads; but the difficulty of securing in a building the perfect workmanship used in a test makes all such records of small value as compared with custom arising from an accumulation of experience, and such custom has decided that 4½ to 5 ft. is the span of flat floor arch combining the necessary strength with desirable economy of construction under working conditions. As thus used, these arches are very economical, very adaptable, and elastic in their application, and requiring only a moderate degree of skill on the part of the workmen. They are made of hollow terra-cotta blocks, with joints inclined at a fixed angle, which is only a rough approximation to the theoretical radiation of such joints in a flat arch; but there is no practical difference in the strength, and there is a great gain in having three patterns in all the blocks, viz., the springer, which rests on the flanges of the floor beam, the intermediate blocks, which are all cut to the same inclination, and the key-block, which, of course, has the sloped joint on both sides. The springer is made so that the lower surface forming the soffit, or ceiling, stands about 1½ ins. below the lower flange of the iron, and covers one half of that soffit. The work is set upon a centering consisting of simple scaffold boards hung 1½ ins. below the soffits of the iron beams; upon this centering the arch blocks are laid, and there jointed and flushed in cement. As soon as the work is set the centering is removed to a new panel, so the work goes on continually. It is customary to set the arches forming the floors as soon as the iron is ready for them, without regard to the condition of the walls or the absence of any roofing. In a building being hastened the ironwork will usually be seven or eight stories high before the walls are commenced, and the floors will be within two or three stories of the top at any time. Upon these arches a layer of cinder concrete is deposited, and upon this the finished floor, consisting of paving or tiling, or a composition of a concrete nature, or sleepers and wooden floor. A variety of floor arches of late date is the "end construction" arch, in which the perforations of the terra-cotta are arranged in the direction of the stress in the arch instead of at right angles to it, so that a larger quantity of material is used under strain; but it is doubtful whether this is of much real advantage — it is rather the product of severe testing than of any practical need.

(*Continued.*)

[1] The original specifications of the Onondaga County Savings Bank, Syracuse, N. Y. designed by the author of the paper, were exhibited in the meeting room.

Masons' Department.

ESTIMATING.

BY JOHN LYMAN FAXON.

GENERALLY, a contract nowadays embraces approximately 50% of subwork, estimated by the several subcontractors, and, as a rule, the contractor for the whole adds the aggregate of the lowest subs to his estimate of the general work (masons' and carpenters' work) to make up the bid proper, with such percentage of profit on the subs as he thinks his chances will stand; some contractors adding no per cent. in the bid, and if they get the job, then beating down the subs to get the profit which should have been added in the estimate. So, nine times out of ten, the contractor for the whole only estimates in detail on the masons' and carpenters' work and contingencies relative to subwork; and as, in nine cases out of ten, the aggregate of the subs used by all contractors for the whole is approximately the same sum, the variance in the bids is one of work estimated by the contractors of the whole. Later on I will illustrate this point somewhat in detail.

As to estimating by the cubic foot, a building may be intelligently and safely so estimated, providing the contractor has familiarized his judgment with the varying conditions of location, style, construction, finish, and general requirements of plans, more or less general and applicable to all buildings of any importance, and has ample tabulated data filed away for ready reference, consisting especially of records of ground areas, cubic contents, bids, and blue prints or published plans, and copies of specifications, from which he can deduce an intelligent basis for an estimate on the special building in hand.

But such estimating cannot be done recklessly, by simply averaging the cubic foot cost of three or four buildings, all varying materially in size, style, construction, and finish, and then multiplying the cubic foot contents of the building to be bid on by the average cubic foot cost, as in a case which came to my notice not long ago, in which case the contractor got the job, but at a good many thousands of dollars less than the next lowest bidder.

In estimating by the cubic foot, one element should be taken into account, *i. e.*, that it costs less, proportionately, to build a large building than a small one, and *vice versa*, this difference does not vary much from 4% for an increase or decrease of 25% in size (cubic feet). For instance, suppose we are to base our estimate on a building of 1,000,000 cu. ft., and which cost, when built, $200,000; now if the building to be estimated (all conditions being equal) contains 1,250,000 cu. ft., it will cost $250,000 — 4%, or $240,000. Again, if the building to be estimated contains 800,000 cu. ft., it will cost $160,000 + 4%, or $166,400. But, supposing, in either case, that the market has advanced 5% since the erection of the building taken as a basis, then the cost in the first instance will be $250,000 + 5% — 4% = $251,500; and the cost in the second will be $160,000 + 5% + 4% = $174,720; and if the market has fallen 5%, the calculations will be the reverse of above.

Now, supposing we have the same building, of 800,000 cu. ft. to estimate (on basis of 1,000,000 cu. ft., at 20 cents per cubic foot), but with varying conditions, duly noted and tabulated, the estimate will be as follows: —

	800,000 cu. ft. @ 20¢		$160,000,000
Cr.	Difference in Foundation	$896.41	
	„ „ Sandstone	1,150.25	
	„ „ Brickwork	1,916.33	(face)
	„ „ Roofing	500.00	4,462.99
			$155,537.01
Dr.	Difference in Steel Work	$2,250.00	
	„ „ Marble „	465.20	
	„ „ Electric „	360.00	
	„ „ Finish	1,875.40	
	„ „ Painting	637.28	5,587.88
			$161,124.89
	4% on a/c of reduced size		6,444.99
			$167,569.88

$167,569.88 ÷ 800,000 cu. ft. = 20 94/100 cents per cubic foot

I will now illustrate some estimating; bids by contractors, in five cases of which I have records.

(1) A building of approximately $100,000 cost, for which the plans were revised and a second call for bids made: the first bids ranged from $97,000 to $130,000, a difference of 33%. Of the several bidders, A, B, and C bid both times.

A's *first bid*, $98,413.00
B's „ „ 104,974.00
C's „ „ 108,900.00

The subs amounted to $54,322.00, so that the general work (masons' and carpenters' work) stood as follows in the first bids: —

A, $98,413.00 — $54.322.00 = $44,091.00
B, 104,974.00 — 54,322.00 = 50,652.00
C, 108,900.00 — 54,322.00 = 54,578.00

showing a difference (on masons' and carpenters' work) between A and C of $10,487.00, or 23 8/10%.

In revising the plans and specifications, the following reductions were made, as estimated by the architect: *a*, Subwork, $8,387.68 (the subs reduced their estimate $11,687.48). *b*, Plumbing omitted from general contract, $3,500. *c*, Masons' and carpenters' work, $2,691.20. Total, $17,878.68, which deducted from the original bids of A, B, and C *would* make them stand: —

A's revised estimate, $98,413.00 — $17,878.68 = $80,534.32
B's „ „ 104,974.00 — 17,878.68 = 87,095.32
C's „ „ 108,900.00 — 17,878.68 = 91,021.32

The second bids of A, B, and C *were*: —

A, $93,000; B, $90,974; C, $90,900; showing that A increased his bid for the whole $12,465.68; B increased his bid $3,878.68; and C reduced his bid $121.32; but the subs, revised, amounting to $42,634.52 taken from A, B, and C's second bids, makes the estimates for masons' and carpenters' work appear as follows: —

A's *second bid*, $93,000.00 — $42,634.52 = $50,365.48
B's „ „ 90,974.00 — 42,634.52 = 48,339.48
C's „ „ 90,900.00 — 42,634.52 = 48,265.48

showing (with $2,691.20 reduction in masons' and carpenters' work) that A increased his estimate $6,274 48; B reduced his estimate $2,312.52; and C reduced his estimate $6,312.52; and D, who did not bid the first time, came in with a bid of $84,827, or $42,192.48 for the masons' and carpenters' work, 19 3/10% less than A; and D executed the work and made a fair profit; and D's bid was within $1,200 of the architect's estimate for the whole.

(2) Four buildings, the average lowest bids being $212,000, and the average highest bids being $258,000. I will designate these as *a*, *b*, *c*, *d*, and the nineteen individual bidders as A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, respectively.

A bid on *a* and *d*.
B „ „ *a*.
C „ „ *a*, *c*, and *d*.
D „ „ *a*, *b*, *c*, and *d*.
E „ „ *a* and *b*.
F „ „ *a*, *b*, *c*, and *d*.
G „ „ *a*, *b*, *c*, and *d*.
H „ „ *b*, *c*, and *d*.
I „ „ *a*, *b*, and *c*.
J „ „ *b*.
K, L, M, N, O, P bid on *c*.
Q, R, S „ „ *d*.

The lowest and highest bids on *a* were $226,900 and $259,943, a difference of $33,043, or 14 5/10%.

The lowest and highest bids on *b* were $157,900 and $177,642, a difference of $19,742, or 12 5/10%.

The lowest and highest bids on *c* were $217,000 and $263,800, a difference of $46,800, or 21 6/10%.

The lowest and highest bids on *d* were $242,971 and $328,823, a difference of $85,852, or 35 1/3%.

The average of differences being 21%.

The difference in the subs were as follows: —

a, 40%; *b*, 43%; *c*, 43 1/5%; *d*, 36 4/5%.

Deducting the aggregate of the lowest subs from the respective bids, the estimates on masons' and carpenters' work for the several jobs appear to be as follows:—

Job *a*	A's estimate	52 8/10%	of the whole.
	C's "	48 3/10%	" " "
	D's "	48 2/10%	" " "
	E's "	48 1/4 %	" " "
	F's "	46 5/10%	" " "
	G's "	46 %	" " "
	H's "	55 %	" " "
	I's "	48 2/10%	" " "

A difference of 19 6/10%.

Job *b*	D's estimate	53 1/10%	of the whole.
	E's "	53 5/10%	" " "
	F's "	50 3/10%	" " "
	G's "	54 4/10%	" " "
	H's "	53 7/10%	" " "
	I's "	53 4/10%	" " "
	J's "	48 7/10%	" " "

A difference of 11 7/10%.

Job *c*	C's estimate	59 3/10%	of the whole.
	D's "	58 3/10%	" " "
	F's "	54 4/10%	" " "
	G's "	60 %	" " "
	H's "	57 7/10%	" " "
	I's "	57 3/10%	" " "
	P's "	51 4/10%	" " "

A difference of 16 7/10%.

Job *d*	A's estimate	51 3/10%	of the whole.
	C's "	56 %	" " "
	D's "	46 8/10%	" " "
	F's "	52 8/10%	" " "
	G's "	51 5/10%	" " "
	H's "	54 %	" " "
	Q's "	60 4/10%	" " "

A difference of 29%.

The average of estimates on masons and carpenters being:—

a, 49 16/100%; *b*, 52 45/100%; *c*, 56 9/10%; *d*, 53 27/100%.

So on job *a*, C estimated the closest to average.
" " *b*, D " " " " "
" " *c*, I " " " " "
" " *d*, F " " " " "

Further, G, whose bid was lowest on job *a*, estimated highest on jobs *b* and *c*; and D, whose bid was lowest on job *d*, was near the highest on jobs *b* and *c*; and H, whose bid was the highest on job *a*, was at about the mean on jobs *b*, *c*, and *d*. So it appears — what I have observed in practise — that the contractors for the whole do not seem to have any definite or logical systems of estimating work — masons' and carpenters' work — with which they are supposed to be familiar.

A few years ago a contractor came to me to make an estimate on buildings which he "wished to get," saying that he had estimated the work, but that his estimate was so high that he was in doubt about the matter. I made a careful estimate of what I considered to be the *net cost* of the work, advising him to add such per cent. of profit as he desired. My estimate was about 20% more than the contractor's, and he, more in doubt than ever, split the difference between his estimate and mine and put in a bid accordingly. Another contractor got the job at a much lower bid, and I subsequently learned that the successful bidder had made a mistake and lost a good many thousands of dollars, and that the estimate I had made was about the correct thing.

Space does not permit of my showing in detail the various methods of estimating, good, bad, and indifferent, so as to cover any extended ground, so I will confine my illustrations to a comparatively simple, every-day matter, and one in which I think more miscalculations are made, and liable, than in most other things estimated upon by the contractor for the whole, viz., brickwork. For instance, suppose we have the external wall of a large building to estimate, which we will say is 20 ins. thick and to be built of face bricks @ $28 per M.; inside lining of best hollow bricks, and filling of best hards. Now, the average contractor will go through the laborious calculation of figuring (after getting the area of the face and outs) the cubic feet and thousands of bricks of each kind, and cost per M.; requiring much time, paper, and expenditure of mental force, with liability of not arriving at a correct or close estimate seven times out of ten, when the calculations can be made correctly with one third of the time and figures. Supposing we find that the face area of the wall is 23,642 sq. ft. and the area of voids 6,289 sq. ft., which leaves 17,353 sq. ft. Now for this 20 in. wall, the through and through brickwork will cost, say, per M.:—

4 ins.	of face bricks and laying	@ $40 per M.	× 1 =	$40.00
12 "	" hard "	" "	@ $16 " M.	× 3 = 48.00
4 "	" hollow "	" "	@ $17 " M.	× 1 = 17.00
20 "	thickness = per face M.			$105.00

i. e., $105 per M. for superficial face through the wall. Now, the average run of 8 in. bricks will lay about (close to) 21 bricks to the cubic foot or 7 bricks to the face foot, or 143 superficial feet to the M. So, having arrived at the cost of the brickwork through the wall, per M. for its thickness, we proceed to estimate as follows:—

$$17,353 \div 143 \times \$105 = \$12,741.65,$$

to which will be added, if so designed, cost of molded bricks, extra for turning arches, etc., and per cent. for waste stock. Or, supposing we find that we have 10,892 superficial feet net of inside 16 in. wall of common brickwork, we then have 16 ins. @ $16 per M. × 4 = $64 per M. through the wall, and the calculation is

$$10,892 \div 143 \times \$64 = \$4,874.24,$$

to which we add for arches, etc., and per cent. for waste stock. When one is used to this system of estimating, calculations are made as quick as one can think, with surety and least expenditure of time and paper, to say nothing of "getting the pencil sharp," and all jobs can be estimated on the same basis, and show comparatively the same results.

Supposing the exterior wall is a 20 in. wall with selected common facing, light hard filling and hollow lining, then the basis is:—

4 in.	face bricks and laying	@ $20	× 1 =	$20.00
12 "	light hards "	"	@ $15 × 3 =	45.00
4 "	hollow "	"	@ $17 × 1 =	17.00
20 "	thickness = per face M.			$82.00

$$17,353 \div 143 \times \$82 = \$9,950.62$$

Supposing the same wall is a 16 in. wall with facing bricks 12 ins. at $48 per M.; on an 8 in. brick basis the facing will be $32 + the laying, or

4 in.	face bricks and laying	@ $44	× 1 =	$44.00
8 "	hard "	"	@ $16 × 2 =	32.00
4 "	hollow "	"	@ $17 × 1 =	17.00
16 "	thickness = per face M.			$93.00

$$17,353 \div 143 \times \$93 = \$11,285.46$$

An intelligent contractor can readily make out a table of brickwork and cost (two or three times a year, covering the changes of the market) embracing all conceivable combinations of stock and different thickness of walls, to fit almost any conceivable case for application in estimating; and when once the system is well in hand, the application of it will come to mind without effort.

The same idea is applicable to estimating carpenter work of all kinds, framing, finish, etc., that is, estimating by superficial foot instead of wasting time, patience, and figures on estimating in detail by stock, labor, etc.

If these papers have been, or may be, of any service or help in establishing a clearer appreciation as to what the obligations of contracts are; of a better understanding between contractors and architects, and contractors and subs; of a more ready disposition for honest work at a fair price, and a more intelligent basis of estimating, the space allotted to them will have filled its mission.

Brick and Terra-Cotta Work in American and Foreign Cities, and Manufacturers' Department.

NEW YORK. — There is scarcely any line of business in this city which has not felt in one way or another the effects of the great celebration welcoming Admiral Dewey. Our best sculptors dropped everything, and during the hot August days devoted all their time and energy towards the production of the magnificent triumphal arch in Madison Square, with no recompense save the love of art, and the satisfaction of having done their share in beautifying the city and educating the masses. Their work has not been in vain, for the arch was enthusiastically appreciated and probably has been seen in illustrations by the entire country. It is very gratifying to know that the arch will probably be rebuilt permanently in marble, and interest in the matter has been aroused not only among our wealthy citizens, most of whom are patriotic and public spirited, but among the poorer people also the feeling is that they would like to contribute according to their means.

Amid so much rejoicing we regret being obliged to record anything unpleasant, but the recent unreasonable demands made by the local labor unions have caused much unpleasant comment. Notably, during the preparations for the Dewey days, when architects and sculptors were giving all their best efforts for no return, and when mechanics were kept busy and well paid, they took the opportunity to strike for higher wages and a half day Saturday all the year round, seriously delaying the important work in hand. It is not by want of faith that the workmen will improve their position before the public. The regrettable incident referred to shows more than ever the necessity of standing and properly accredited courts of arbitration within the trades to dispose of disputes between masters and men.

The award of first prize in the competition for the new Custom House has been given to Cass Gilbert, of St. Paul, Minn. It is said that the design will be an ornament to the city.

Architect George B. Post, of New York, has been selected as architect for the new Department of Justice Building in Washington, D. C., which is to cost $900,000. The other architects whose plans were favorably commended were Price & Aiken and Warren & Wetmore, also of New York.

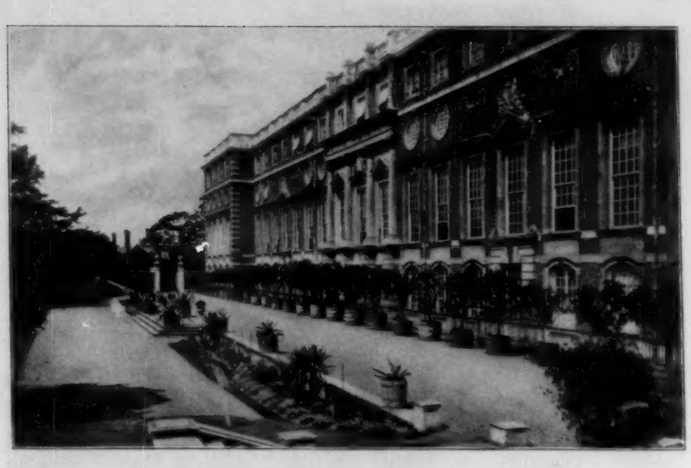
In view of the rapid multiplication of elevator apartments up town, with the inevitable depressing result on rents, it will be interesting to builders to learn of the unqualified success of an experiment with a seven-story building of this nature in Washington Square, North. The house, the interior of which is only just receiving its finishing touches, contains twenty-one apartments. All but three have already been rented, and for these propositions have been received. The average rent is $1,200 for eight rooms and bath.

The dearth of iron for building purposes is one of the most discouraging problems that the contractor has to deal with to-day. The great increase in the cost of material, retarding if not upsetting millions of dollars worth of new work, was bad enough, but to have it come about that when the client is ready to pay the price it is impossible to obtain the goods, is a peculiarly aggravating misfortune. Grumbling about so unusual a situation, however, does no good, and owners and builders are striving to see whether there is not some way to turn the corner. One loophole that has been taken advantage of is the substitution of the old-fashioned, solid walls in place of the iron skeleton. In a great many cases, where buildings are of low or only moderate altitude, this substitution is perfectly feasible, and considering the higher cost of steel, it may not be so uneconomical as it was a year ago. The difference between masonry and steel construction is, of course, more apparent the higher the building is carried, not only in cost of structure, but in area of lot occupied by walls and other supports.

James E. Ware & Son have prepared plans for a new ten-story

HAMPTON COURT PALACE, LONDON, ENGLAND. WEST FRONT.

HAMPTON COURT PALACE. FROM EAST.



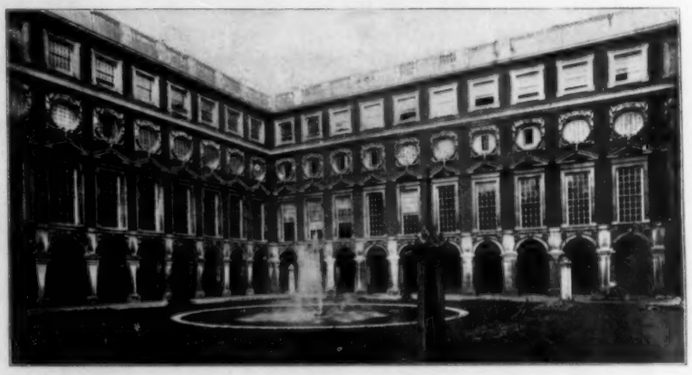
HAMPTON COURT PALACE. SOUTH FRONT.

brick warehouse, to be built on 52d Street, near Seventh Avenue, for the Manhattan Storage Company; cost, $200,000. Geo. F. Pelham has planned two six-story brick and stone flat buildings, to be built on 19th Street, near Third Avenue, at a total cost of $60,000. Brun & Hauser have planned a brick church building for the French church of St. Esprit; cost, $50,000. Carrere & Hastings are preparing plans for a brick and stone church for the First Church of Christ, Scientist, to be built at 96th Street and Central Park, West; cost, $30,000. Ernest Flagg has planned a brick stable, to be built on 87th Street, near Broadway; cost, $17,000.

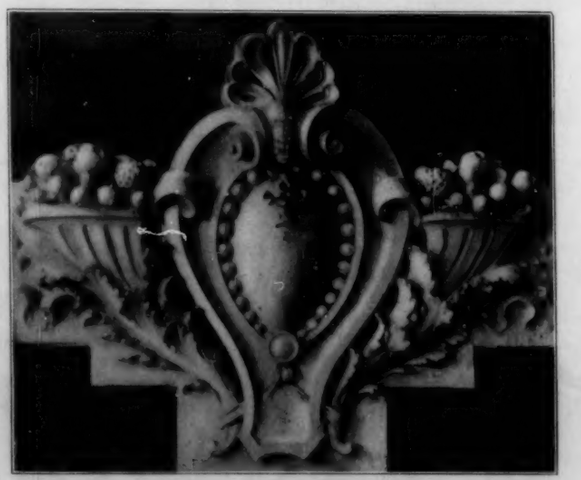
PHILADELPHIA. — The records of the Building Inspector's Bureau would seem to indicate that building is not falling off in Philadelphia, but unfortunately the number of permits issued by that office, each after the due filing of a drawing of the work proposed, gives but a poor idea of the amount of work emanating from the offices of architects. At the present time but few of the older and larger offices have an average number of contracts on hand. This is not to be entirely accounted for by the presence amongst us of so many younger architects, each doing his quota of business, but to a large extent to the fact that builders are gradually encroaching on the demesne of the architect, many employing quite a large staff of draftsmen on the designs, principally for business blocks, factories, and heavy operations generally, which they turn out.

That this tendency of business people to fight shy of the architect is to be deplored by others besides those of the profession goes without saying, and one is forced to ask, Is it true that the architect is apt to lavish more money on display of architectural adornment than often the circumstances warrant? After a review of recent commercial erections in the city, it is hard to deny it.

Amongst those not feeling any effect of the foregoing is the firm of Rankin & Kellogg, who, with other affairs, are preparing plans for a church to be built on Broad Street below Spruce. The new post-office by them in Camden, together with a Pompeian brick and terra-cotta bank by Frank Miles Day & Brother, are perhaps the most pleasing buildings put up in that town in recent years.



HAMPTON COURT PALACE. FOUNTAIN COURT.



TERRA-COTTA CARTOUCHE.
Executed by the New York Architectural Terra-Cotta Company.

A number of years ago, nearly all the new city houses were from the office of T. P. Chandler, but lately much of his work has lain out of town. At 22d and Locust Streets has been commenced a colonial house from his designs.

Mr. Windrim is taking every safeguard in the erection of the Smith Memorial Entrance to Fairmount Park. A model of one half of it has been erected on the site, life size. The design consists of side arches for foot traffic, while the driveway is flanked by columns. It is eventually to be in white marble.

The T Square Club has cut free from the Academy of the Fine Arts for its coming exhibition. Heretofore the architectural exhibit was part of the Academy's yearly display of art works. Naturally, the drawings from the architect's table received but scant notice from the crowds that thronged the art galleries, and it has been felt for some time that a separate exhibition was necessary to give an architectural display the dignity and to draw to it the public notice it deserves.

The housing of the National Export Exposition, whose gates are now open, on the west bank of the Schuylkill, seems but an insignificant affair after the World's Fair and the Omaha Exposition triumphs. Here the architecture is extremely simple, no effect of lagoon nor grand court having been attempted. A portion of the buildings are built for permanency, with the exception of the staff casing of the exterior, which is to be replaced by marble at a later time.

ST. LOUIS. — It is gratifying to note the increased interest taken in architecture by the layman, and his appreciation of the efforts of the architects to raise the standard of their profession. 'Tis only within the last few years that a limited competition for a proposed building has been heard of, or that a client would consent to pay those whom he might ask to prepare preliminary sketches. There has been three such competitions recently: the St. Louis Club last year, the buildings for the Washington University, and the St. Louis Trust Company's building. The competition for the latter resulted in Shepley, Rutan & Coolidge being selected.

The permits issued by the building commissioner for September are much below those for the same month, in a number of years, amounting to only $514,663, while for September, 1898, they amounted to $1,001,350. This is a good illustration of the condition of the building business in this city at the present time, and there is no one who can offer a reasonable explanation, as all other classes of business are unusually active. The earlier part of the season gave indication of much work being done, and there was quite a rush among architects and builders for a while, but it was short lived, and the outlook for the future offers but little encouragement.

HOUSE AT ST. LOUIS, MO.
Shepley, Rutan & Coolidge, Architects.

Barnett, Haynes & Barnett have prepared plans for a church for St. Kevins parish, which will cost $100,000. It is to be of Bedford stone, and will be in the Romanesque style. On each side of the nave in front there will be an octagonal tower.

There has been but little labor trouble during the season, but now the carpenters have concluded to ask for ten cents an hour advance, beginning the first of next April, and have so notified the builders. The present rate is thirty-five cents per hour.

MEDALLIONS, SCHOOL OF MINES BUILDING, BUTTE, MONTANA.
Executed in terra-cotta by the Winkle Terra-Cotta Company.

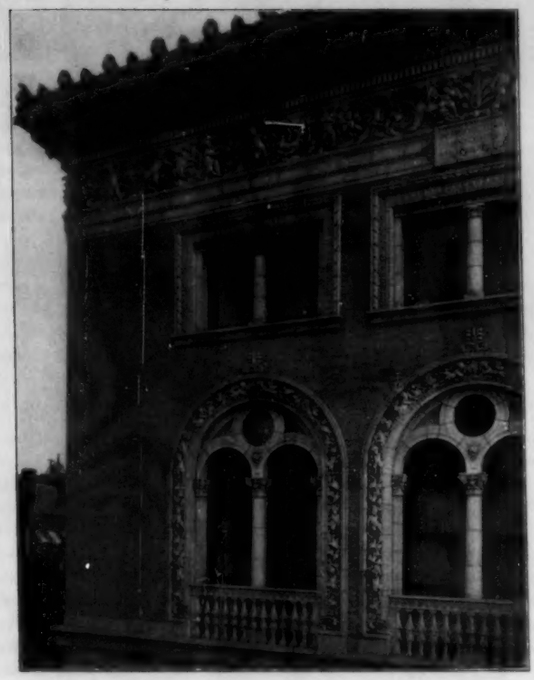
TERRA-COTTA CAPITAL.
Executed for the Albany, N. Y., Railway Station, by the Perth Amboy Terra-Cotta Company.
Marcus T. Reynolds, Architect.

MANUFACTURERS' CATALOGUES AND SAMPLES DESIRED.

THE following-named architects would be pleased to receive manufacturers' catalogues and samples: August M. Bleeck, 3923 Cleveland Avenue, St. Louis, Mo.; Foreman & Son, Ward-Nichols Block, Marietta, Ohio; J. R. Nevins, 307½ Main Street, Houston, Texas; Frederic Wm. Striebinger, New England Building, Cleveland, Ohio.

AN unusually interesting exhibit of pottery and antique textiles, by the Grueby Faience Company, is being held (October 2–31), in the Art Gallery of the Department of Fine Arts, Pratt Institute, Brooklyn, N. Y.

The Grueby pottery is first of all an evidence that American industrial art is not completely enslaved to machinery and mechanical reproduction. The makers of this pottery have gone back to the method of the Egyptians and the Greeks; each piece being the



DETAIL, HARTFORD SAVINGS BANK, HARTFORD, CONN.
Peabody & Stearns, Architects.

TERRA-COTTA PANEL, RESIDENCE, PHILADELPHIA.
Executed by the Conkling-Armstrong Terra-Cotta Company.
R. G. Kennedy, Architect.

MERCHANT & Co. have recently issued a small booklet of "Analysis and Tests," showing quality, tensile strength, and uniformity of dimensions of seamless brass and copper tubes manufactured by them. This pamphlet contains much useful information and will be of practical service as a work of reference to architects, engineers, etc.

THE INDIANAPOLIS TERRA-COTTA COMPANY have been awarded the contract to supply the terra-cotta for the Globe-Werincke Furniture Factory, Norwood, Ohio, Harry Hake, architect, Cincinnati. This contract calls for over 100 tons of architectural terra-cotta. They will also furnish the terra-cotta for the Paddock & Hodge Building, at Toledo, Ohio, Joseph S. Neills, architect.

THE POWHATAN CLAY MANUFACTURING COMPANY are to supply 45,000 of their silver-gray brick for a new business block at Richmond, Va., M. J. Dimmock, architect; George L. Powers & Bro., contractors. They will also supply similar brick for seven residences, corner of 2d and Marshall Streets, Richmond, Fritz Sitterding, owner and contractor.

handiwork of the potter and the artist and bearing the stamp of individuality. First shaped on the wheel, the form, while still plastic, is decorated by modeling upon its surface conventionalized motives taken from plant life, in such a way as to make the ornament structural and essential to the design as a whole. Simplicity and strength of design and color are its first characteristics, whatever richness or special quality of surface may afterwards be given to it in firing.

PANEL, MAIN ENTRANCE, CLEVELAND CHAMBER OF COMMERCE.
Executed by the Northwestern Terra-Cotta Company.
Peabody & Stearns, Architects.

CURRENT ITEMS OF INTEREST.

CHAMBERS BROTHERS COMPANY report a contract for the instalment of a complete brick-making plant for Alexander H. Russell & Sons, near Baltimore. The equipment of this plant includes steam power outfit as well as the brick machinery. The same is now in process of erection.

TERRA-COTTA PANEL.
Executed for the Paul Revere School, Boston, by the Conkling-Armstrong Terra-Cotta Company.
Peabody & Stearns, Architects.

THE UNION AKRON CEMENT COMPANY are supplying their Akron Star cement for the following operations: Four-story terminal warehouse for N. C. Railway, at Baltimore; an extensive addition to the American Steel and Wire Company's works at Worcester, Mass.; and for a large dam near Carthage, N. Y., for the St. Regis Paper Company.

THE ILLINOIS SUPPLY AND CONSTRUCTION COMPANY, St. Louis, wish attention called to the Grath Steel Wall Ties which they are now putting on the market. The special claim which the company make for the tie is that "it is the only tie on the market having circular ends and diagonal center, which holds all over and forms a wedge impossible to pull out." Further particulars regarding same may be seen in the company's advertisement.

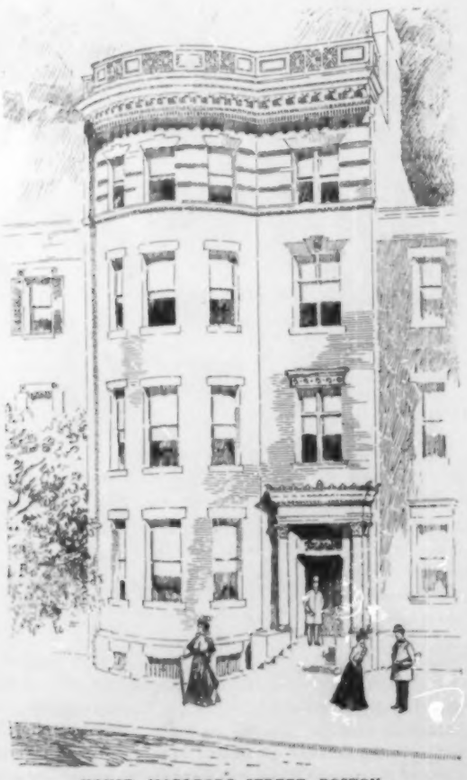
WILLIAM WIRT CLARKE & SONS, Baltimore, have recently published a small but exceedingly interesting volume, entitled "Architect's Hand-book on Cements," Addison H. Clarke, author. In compiling this little work Mr. Clarke has made a distinct effort to be concise in the information given, and to present in most convenient form some of the specifications and formulæ for mixing and using cement as recommended by leading authorities. To architects, engineers,

PANEL, SIXTH STORY, SOUTH BEND HOTEL, SOUTH BEND, IND.
Executed in terra-cotta by the American Terra-Cotta and Ceramic Company.
Shepley, Rutan & Coolidge, Architects.

and builders the usefulness of this work will be extensive. Parties desiring copy of same should communicate with the above company.

THE WHITE BRICK AND TERRA-COTTA COMPANY has closed contracts for the architectural terra-cotta for the following buildings: Engine house, Worcester, Mass., W. H. Harvey, architect; club house, Whitestone, L. I., Wallace & Gage, architects; chapel at West Point, N. Y., Heins & La Farge, architects; stores and lofts, Washington Place and Greene Street, New York, John Wooley, architect; apartments, 111th Street and Eighth Avenue, New York, L. F. J. Weiher, architect; and apartment, 129th Street, near Eighth Avenue, Henry Anderson, architect.

THE new catalogue recently issued by the Evens & Howard Fire Brick Company, descriptive of their fire brick specialties, is a concise, interesting pamphlet of twenty-five pages. It contains some seventy-five illustrations of the different specialties that the company



HOUSE, MARLBORO STREET, BOSTON.
Gay & Proctor, Architects.

PANEL, BETWEEN THIRD STORY WINDOW HEADS, NEW YORK MEDICAL COLLEGE AND HOSPITAL FOR WOMEN.
Executed by the Excelsior Terra-Cotta Company.
Wm. B. Tuthill, Architect.

manufacture in these lines of materials, and gives the dimensions of the bricks, tiles, etc., so described. Price-lists and brief descriptive matter accompany these illustrations. The products of this concern have been well known in the market for over forty years, and in that time have won for themselves a distinctive reputation for unvarying excellence. The same high standard of merit will continue to be maintained by them.

WE are in receipt of a catalogue issued not long since by the Ludowici Roofing Tile Company, Chicago, which contains much information relative to the use of burnt clay tiles for roofing purposes and gives in detail directions for laying same on roofs. The extensive use in Germany of the Ludowici patent interlocking roofing tile is mentioned, and the advantages claimed for this patent are shown by means of sectional cuts representing these tiles when set in their relative position on the roof. The catalogue contains over seventy-five half-tone illustrations of the various styles of tile which the company manufacture; with these are given the dimensions of the tile and their weight per square. For the purpose of showing the artistic effect of these tiles on roofs of various designs, there are illustrations of some thirty different styles of buildings roofed with Ludowici tile. We recommend the catalogue as one that architects will find both interesting and useful in connection with their work. The company will be pleased to send copy of same to any parties on request.

TERRA-COTTA PANEL.
Executed by the New Jersey Terra-Cotta Company.

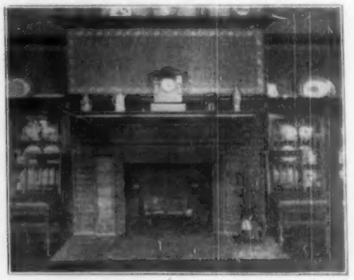
EDWARD R. DIGGS & CO., Baltimore, have secured contract from R. Poole Sons Company, Woodberry, Md., for about 40,000 red stretchers. Joseph Sperry, of Baltimore, is architect of the building in which these brick are to be used.

ASIDE from their Columbus work, the Columbus Brick and Terra-Cotta Company report the following building operations for which they are supplying the brick: Bliss Apartment Building, Washington, D. C., A. Goenner, architect; Lying-in Hospital, New York, N. Y.; hospital, Sycamore Hospital Association, Sycamore, Ill.; depot, Pennsylvania Railroad Company, Leetsdale, Pa.; residence, W. H. Harrison, Cincinnati, Ohio, Foster & Ott, architects; business block, Market and College Streets, Nashville, Tenn.; depot, H. V. Railroad, Lancaster, Ohio; depot, H. V. Railroad, Union Furnace, Ohio; factory, National Cash Register Company, Dayton, Ohio, F. M. Andrews, architect; police station, Detroit, Mich.; water tower, Jackson, Ohio; factory, Denton Shoe Company, Lancaster, Ohio; store and office, Langworth Estate, Cincinnati, Ohio, Boll & Taylor, architects; residence, Birmingham, Ala.; residence, F. B. Semple, Minneapolis, Minn.; two residences, near Exposition Park, Atlanta, Ga.

THE ATLANTIC TERRA-COTTA COMPANY, of New York City, report that they are building a new kiln of extra large capacity. This is the second large kiln erected by this company within the last few months. They also report that they are supplying terra-cotta for the following contracts: Hotel corner 38th Street and Seventh Avenue, New York City, for the White Estate, Barney & Chapman, architects; Perley Free School at Georgetown, Mass., Clarence P. Hoyt, architect; racing stables at Westbury, L. I., for Hon. William C. Whitney, George A. Freeman and C. C. Thain, architects; residence for Gifford Pinchot, Esq., at Washington, D. C., Heins & La Farge, architects; stables at East New York, G. Howard Chamberlain, architect; apartment house, Central Park, West and 92d Street, New York City, George Keister, architect; office building, corner Broadway and Cedar Street, New York City, Bruce Price, architect; office building, Albany, Beach, and Lincoln Streets, Boston, Mass., Peabody & Stearns, architects; police and fire house for the city of Philadelphia, Hazelhurst & Huckle, architects; valve house, Allegheny Avenue, Philadelphia, Wilson Brothers & Co., architects; passenger station, for P. C. C. and St. Louis Railway, Pittsburgh, Pa., D. H. Burnham & Co., architects.

The contracts in the city of Philadelphia were effected through the agent of the company, Mr. J. B. Marie, Real Estate Trust Company Building, Philadelphia, Pa.; the contract in Pittsburgh, through the agents of the company, Page & Co., 232 Fifth Avenue, Pittsburgh, Pa.

MERCHANT & CO., INC., of Philadelphia, New York, Brooklyn, and Chicago, extend a cordial invitation to every one interested in their line of goods to pay a visit to their exhibit at the National Export Exposition now on at Philadelphia, "Section D 6, main building." This company will have representatives there at all times who will be glad to see all visitors and give them information about the goods they have to offer. The exhibit itself is a novel one, consisting of a handsome booth, covered with their well-known Merchant's Spanish tiles, and having two "Star" ventilators, one of the "Standard" form, and the other of the glass top "Skylight" form. Above this roof there is an apparatus which distributes water in the shape of rain, so that the visitor has a practical example of the value of good roofing as a protection against the weather. Within the booth is a full line of the product of their smelting works, consisting of the largest line of Babbitt metals produced in America, as well as every description of solder and newspaper metals, also a full sample line of Merchant's high-grade roofing and bright tin plates, metal ceiling, also brass tubing, which they handle in very large quantities. This exhibit will be of marked interest to every one, and is well worth a visit by those interested in the best bright or terne tin, in ventilators, and in the general line of roofing material, also to the numerous manufacturers and users of machinery who require brass and copper goods and Babbitt metals.

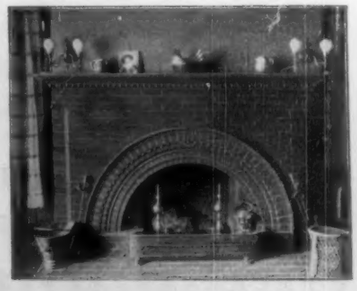


Fireplace Mantels

The richest, most artistic and pleasing, and the most durable, are those we make of our Ornamental Brick. Our customers say so. They don't cost any more than other kinds, and can be easily set by local brick masons. Send for sketch book of 59 charming designs of mantels costing from $12 upwards.

Phila. & Boston Face Brick Co.,

1015 LIBERTY SQUARE, - - BOSTON, MASS.



THE OLD COMPARED WITH THE NEW.

The credit belongs to the Welsh of first making roofing plate which has performed so large a part in sheltering humanity for so many years. The old Welsh method of making tin plate was an honest one, but it had its crudities and imperfections.

The art of making the best tin plate has progressed, as have all other arts, so that the best product of to-day is superior to that made by the old Welsh method. The superiority of the best modern plates lies largely in the thoroughly even distribution of the coating metal over the black sheet. This is an important thing for every buyer or user of tin plate to know.

Messrs. MERCHANT & CO., Inc., of Philadelphia, New York, and Chicago, who have for so long a time made a specialty of the highest grade of plates, have contributed some valuable literature on this material within the last year, viz.: their booklet, "HOW ROOFING TIN IS MADE" and "HOW A TIN ROOF SHOULD BE LAID"; but not less interesting and valuable is their latest issue entitled "NOT JUST AS GOOD, BUT ACTUALLY BETTER," which minutely describes the difference between their method of making plates and the old Welsh method. It will afford them pleasure to mail any one, or all three, of these little works to any name and address sent them to Philadelphia, New York, or Chicago.

Roof Cement

(SILK FIBER BRAND),

Trade Mark.

MORTAR COLORS,

ALL SHADES,
DRY AND PULP.

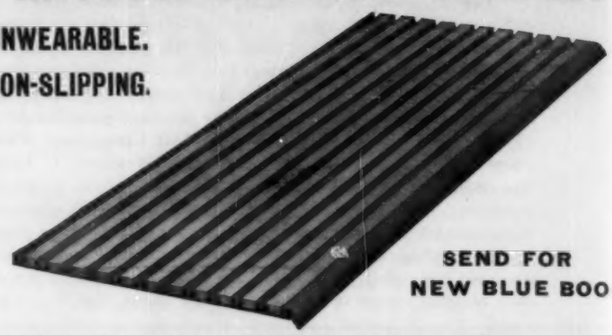
Clinton Metallic Paint Co.,

CLINTON, NEW YORK.

Write for Illustrated Catalogue.

MASON SAFETY TREAD.

UNWEARABLE.
NON-SLIPPING.



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NEW BLUE BOOK.

AMERICAN MASON SAFETY TREAD CO., BOSTON, MASS.

Cabot's Mortar Colors

BRILLIANT, DURABLE, RELIABLE

Not the lowest priced, but so strong and durable and so easy to work that they are actually the cheapest. Used fifteen years by people who insist upon *quality*.

Cabot's Brick Preservative

The only waterproofing for brickwork that is permanent. Three times as waterproof as linseed oil, and goes farther. Prevents water-soaked walls, efflorescence and disintegration by frost.

Send for circulars
and prices.

SAMUEL CABOT, Sole Manufacturer,
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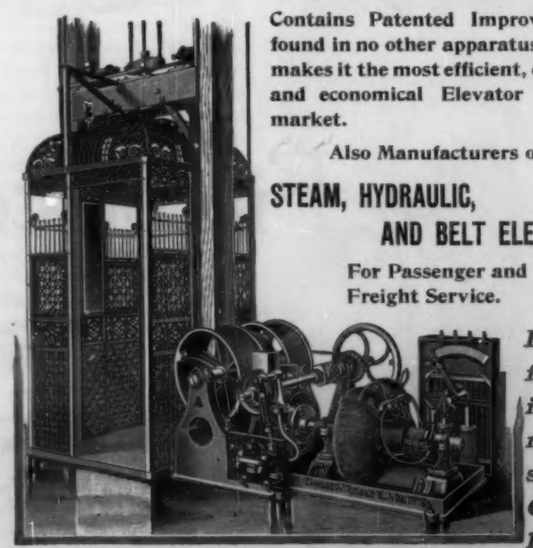
The M. & W.
Direct Electric Elevator

FOR PASSENGER and FREIGHT SERVICE,



Contains Patented Improvements found in no other apparatus, which makes it the most efficient, durable, and economical Elevator on the market.

Also Manufacturers of

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For Passenger and
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Moore & Wyman Elevator and Machine Works,

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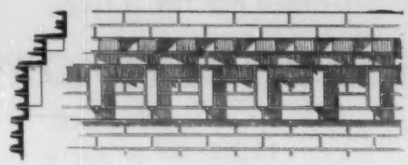
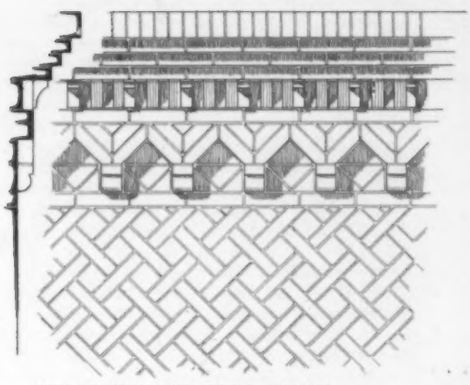
DETAILS OF ITALIAN BRICKWORK
MEASURED AND DRAWN BY WILL S. ALDRICH
CORNICES

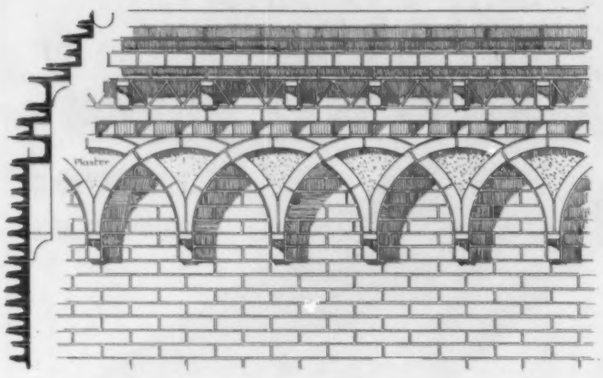


BOLOGNA

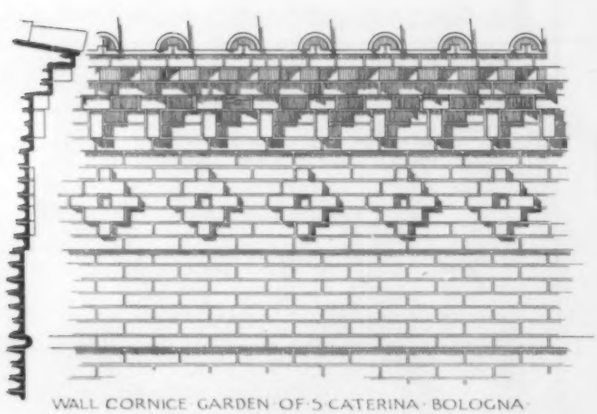


WALL OF BRICK WITH STONE SQUARES

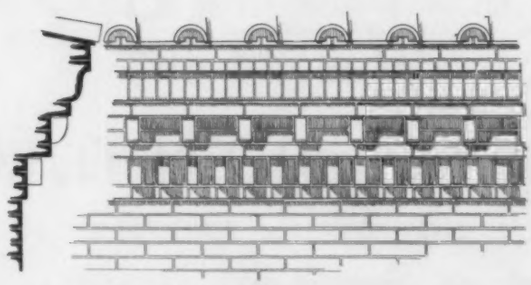
SAN STEPHANO · BOLOGNA ·



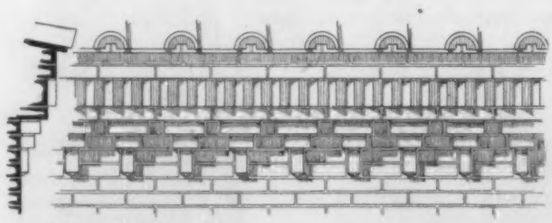
SAN STEPHANO · BOLOGNA ·



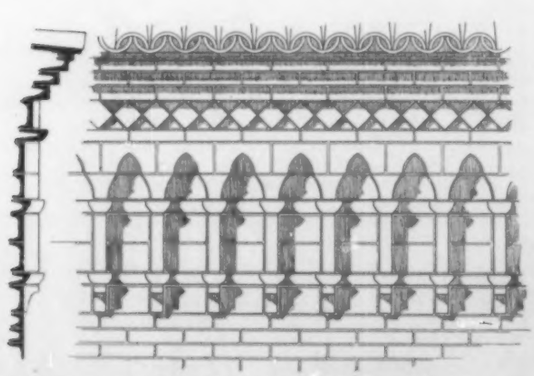
WALL CORNICE GARDEN OF S CATERINA · BOLOGNA ·



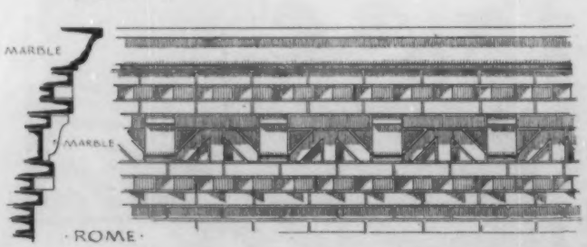
S CLEMENTE · BOLOGNA ·



· BOLOGNA ·

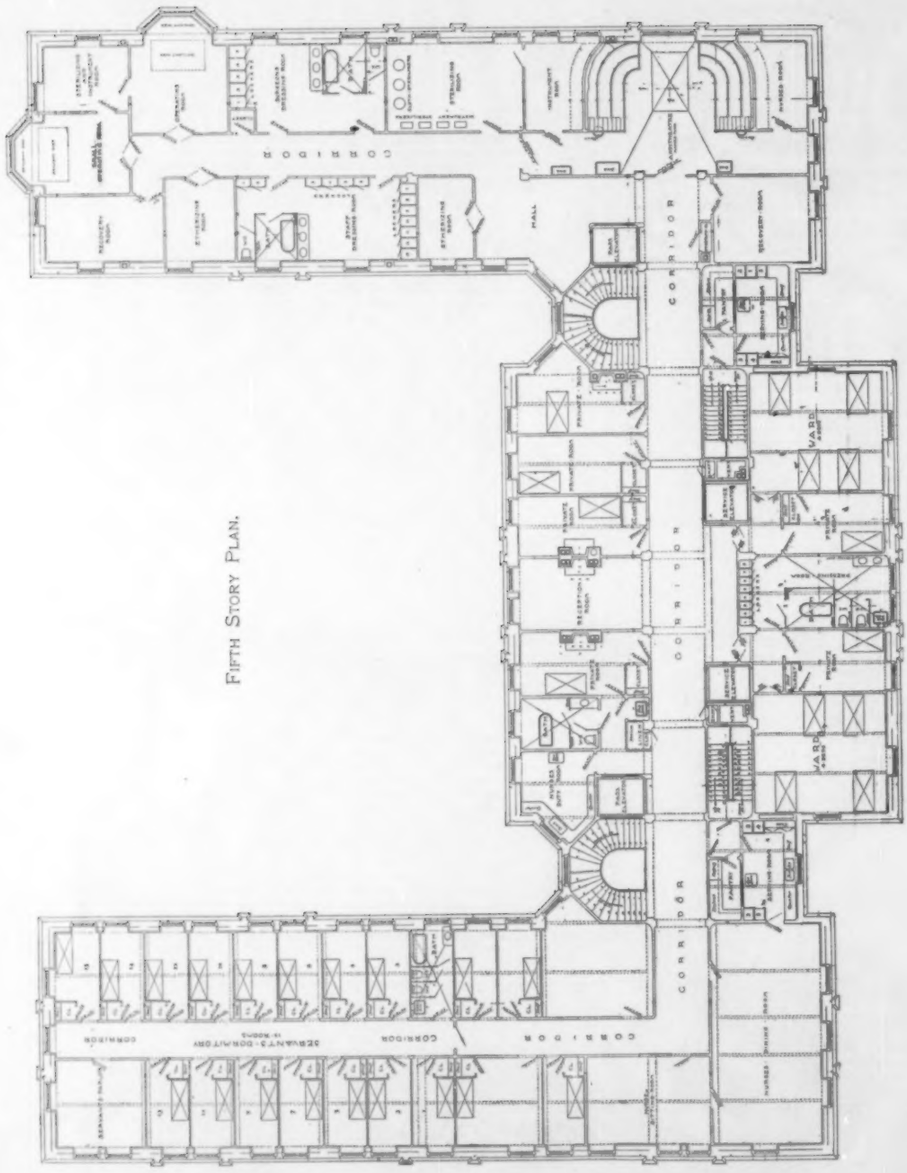


· FORLI ·

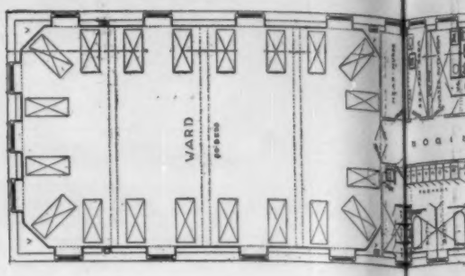


· ROME ·

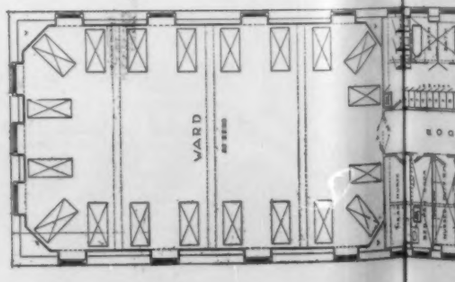
49th STREET.



FIFTH STORY PLAN.



THIRD STORY PLAN.
Typical of Second and Fourth, except 50th Street Wing of Second Story has Servants' Dormitory.

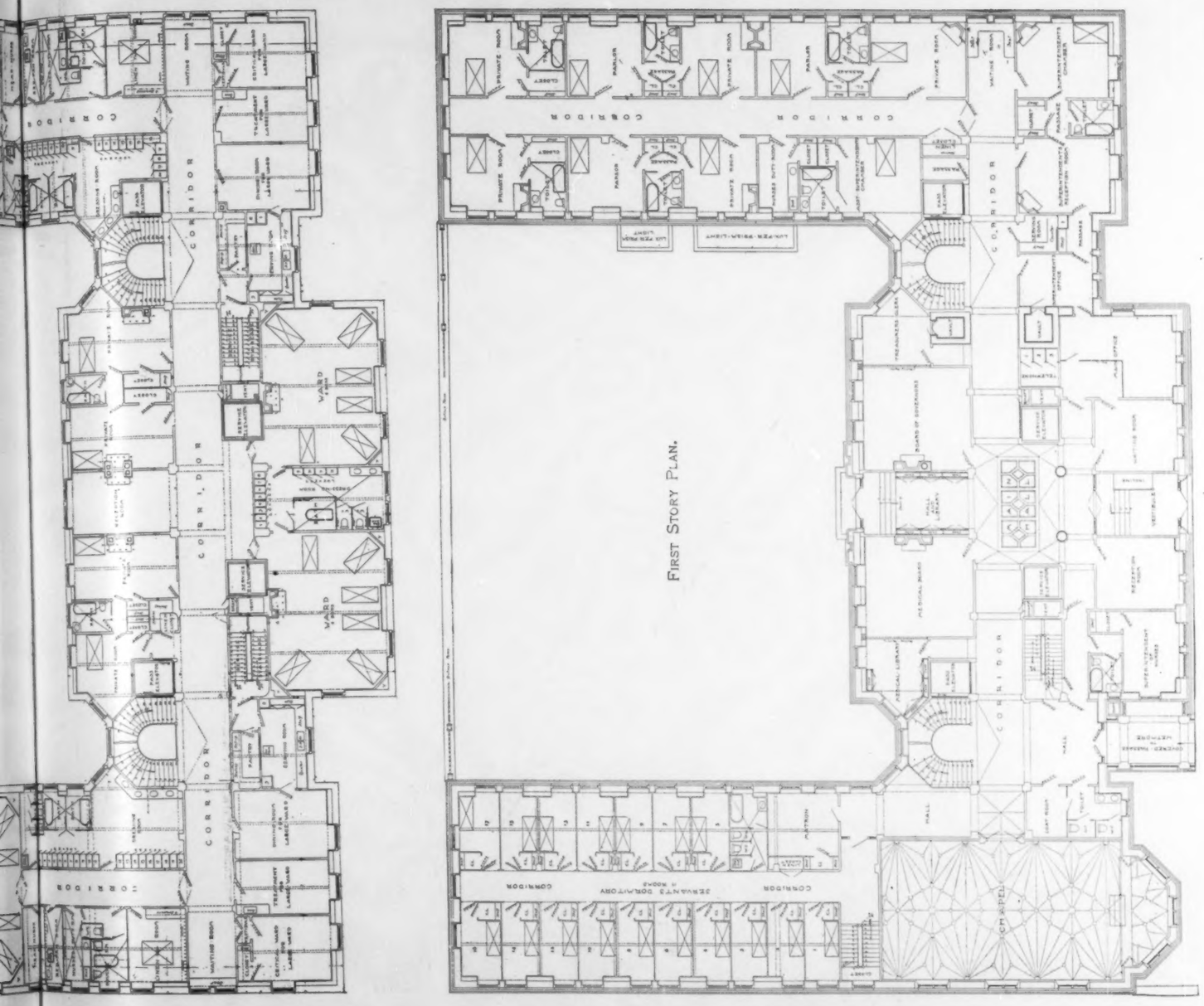


50th STREET

NOTE. Sixth Story Plan has Hospital Staff Dormitory in 50th Street Wing, and upper part of Amphitheater and Solarium in 49th Street Wing. Kitchen and Stores are in Central Pavilion.

PLANS, WOMAN'S HOSPITAL IN THE STATE OF NEW YORK, LE
ALLEN & VINCE, A

49th STREET.



50th STREET.

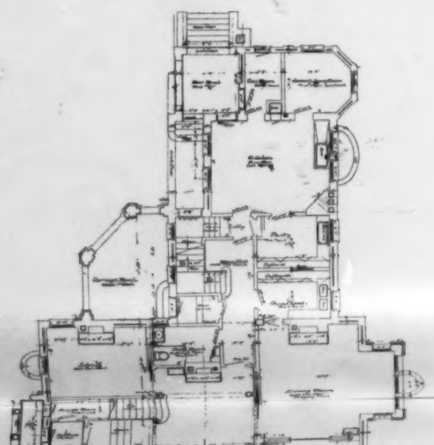
NOTE. Basement: 49th Street Wing has Clinic, Laboratories, etc.
50th Street Wing, Engineer's and Janitor's Rooms and Work Shop.
Central Pavilion, Elevators, Heating and Ventilating Machinery.

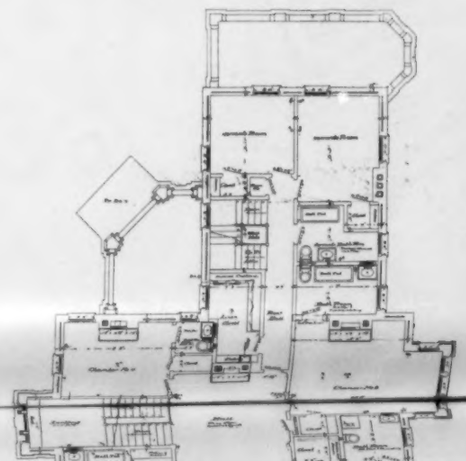
NEW YORK, LEXINGTON AVE. AND 49TH STREET, NEW YORK CITY.

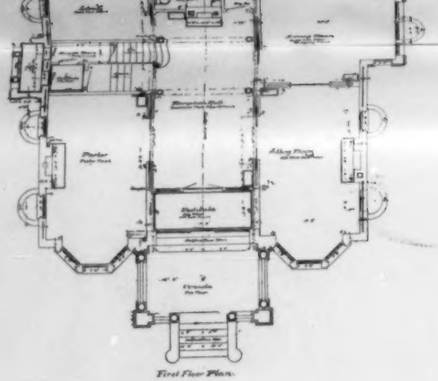
LLEN & VANCE, ARCHITECTS.

REAR ELEVATION.

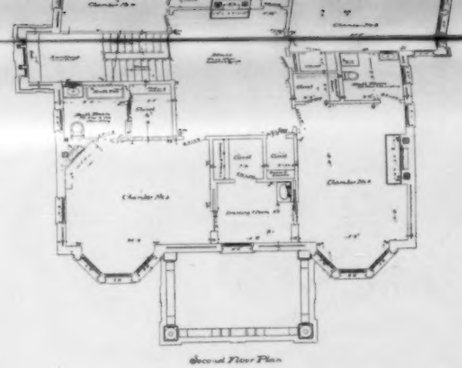
FRONT ELEVATION.







First Floor Plan.



Second Floor Plan.

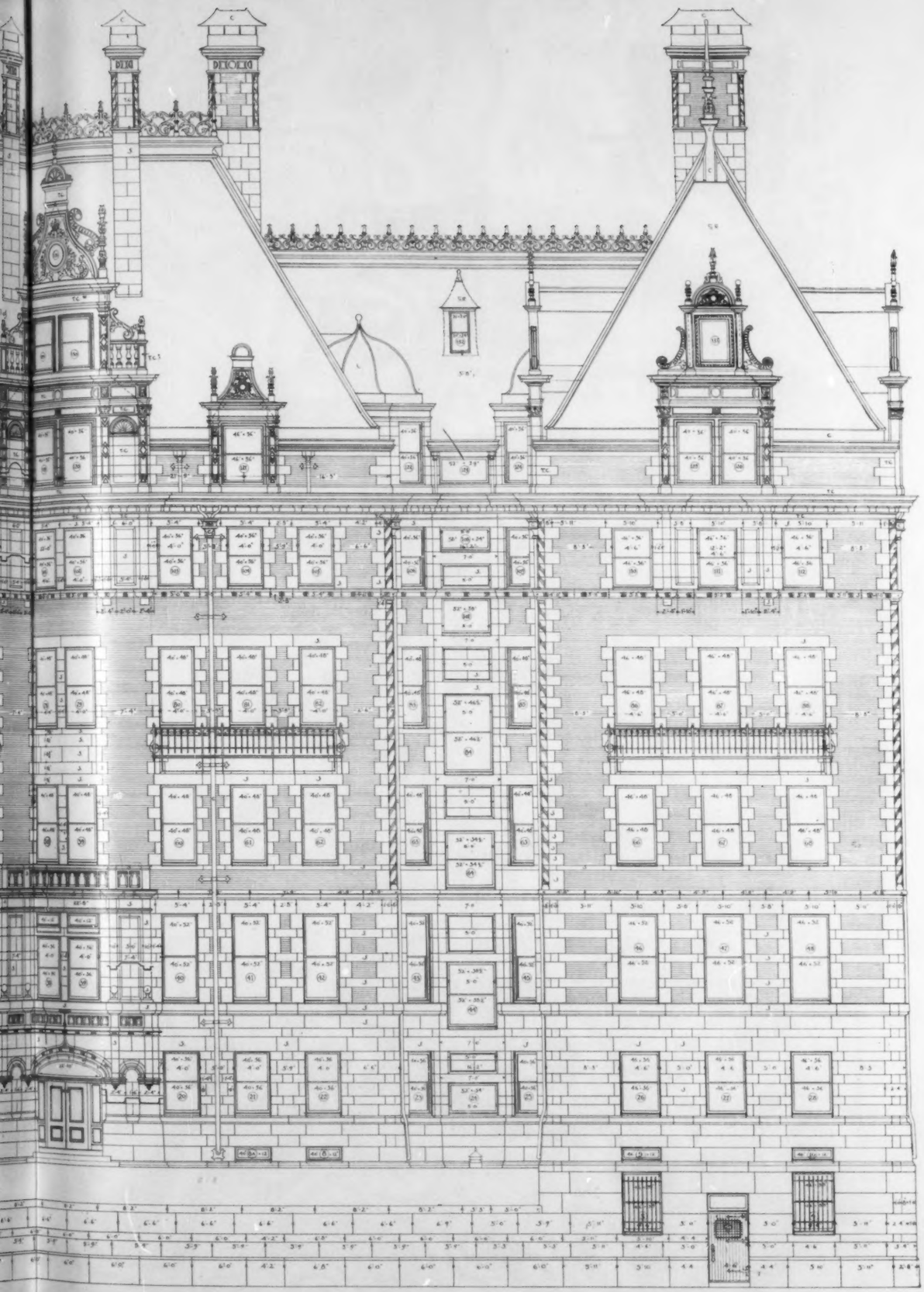
HOUSE AT TOLEDO, OHIO.

E. O. FALLIS, ARCHITECT.

LEXINGTON AVENUE FA

WOMAN'S HOSPITAL IN THE STATE OF NEW YORK, LEXINGT

ALLEN & VANCE, ARCH



ON AVENUE FACADE.

RK, LEXINGTON AVE. AND 49TH STREET, NEW YORK CITY.

& VANCE, ARCHITECTS.

ELEVATION FROM PARK AVENUE.

WOMAN'S HOSPITAL IN THE STATE OF NEW YORK, LEXINGTON AVE. AND 49TH STREET, NEW YORK CITY.

ALLEN & VANCE, ARCHITECTS.